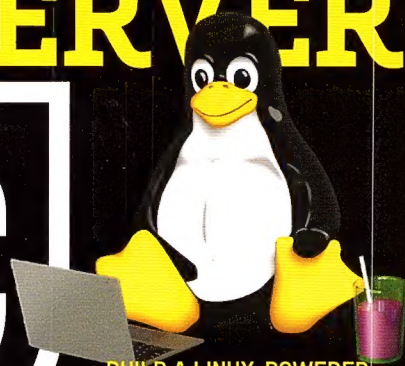


ULTIMATE HOME SERVER

Nov 2016
Issue 434



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GUIDE TO TODAY'S TECH

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How to avoid getting hacked

APC's Editor Dan Gardiner reveals what he does to secure his digital devices.

We've probably all been guilty of it at one point or other, but the honest truth is that, when it comes to digital security, it's all too easy to shove the whole thing into the too-hard basket.

However, a little bit of inconvenience can drastically decrease your chances of being compromised – and the latter is ultimately a much more painful (and often costly) situation to find yourself in. If you've travelled overseas post-9/11 you'll no doubt have been scanned, swabbed and occasionally prodded before you fly and compared to all that, digital security is a whole lot less bothersome.

Stolen credentials are usually sold in bundles of hundreds or even thousands, so individually they're not very valuable. In most situations, hackers won't waste time trying to crack individual user accounts – so you're far less likely to find yourself the victim of hacking if you make yourself a slightly harder target.

A lot of security solutions are literally 'set and forget'. To cover the basics, here's what I would personally recommend:

- Windows or Mac: As the most-used OS in the world, Windows is a huge target for virus makers. However, the Mac is becoming tempting for cyber criminals too, so no matter what desktop OS you're running you should install a security suite, even if it's just a free one.
- Android: Your vulnerability on Android depends on a few factors

if you've rooted your phone and/or you're installing programs or games from outside the Google Play Store, then you're more at risk than users who don't. We recommend installing a security suite (see our reviews on page 58) and installing system updates as soon as they're available.

- iOS: Apple restricts apps' access to low-level processes, so any security software you find on the App Store is snake oil. However, it's not bulletproof, so you should make sure you update the OS when new versions are released as they almost always contain security patches.

Apart from dedicated antivirus software, the other basic bit of kit you should employ is a password manager. Having weak passwords and reusing the same password on multiple sites/services are surefire ways to get yourself hacked.

People often balk at the idea of a password manager because they're conceived to be too inconvenient, but when you're used to using one, it's actually much easier than without.

Thankfully, most of us won't ever be seen as juicy targets for hackers and with these steps, you can make yourself a lot less vulnerable. ■



DAN GARDINER
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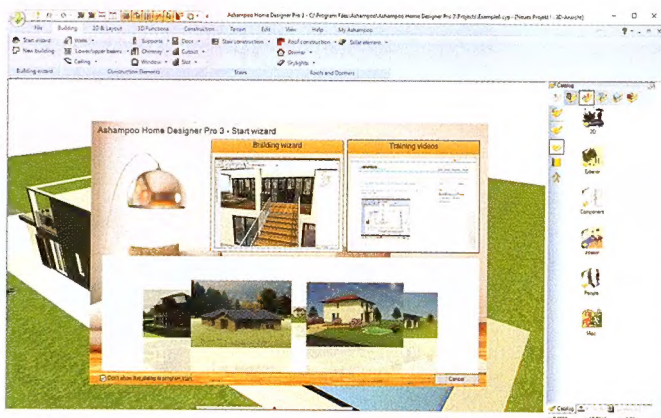
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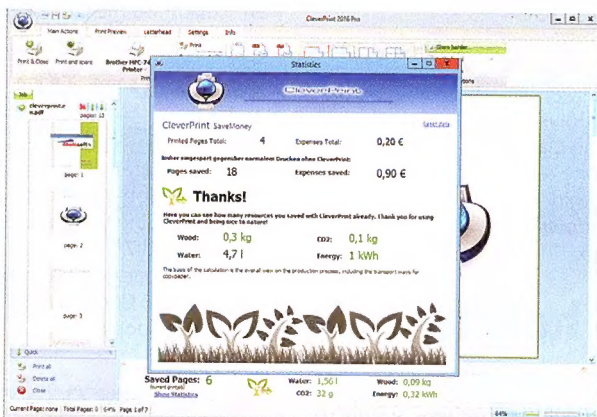
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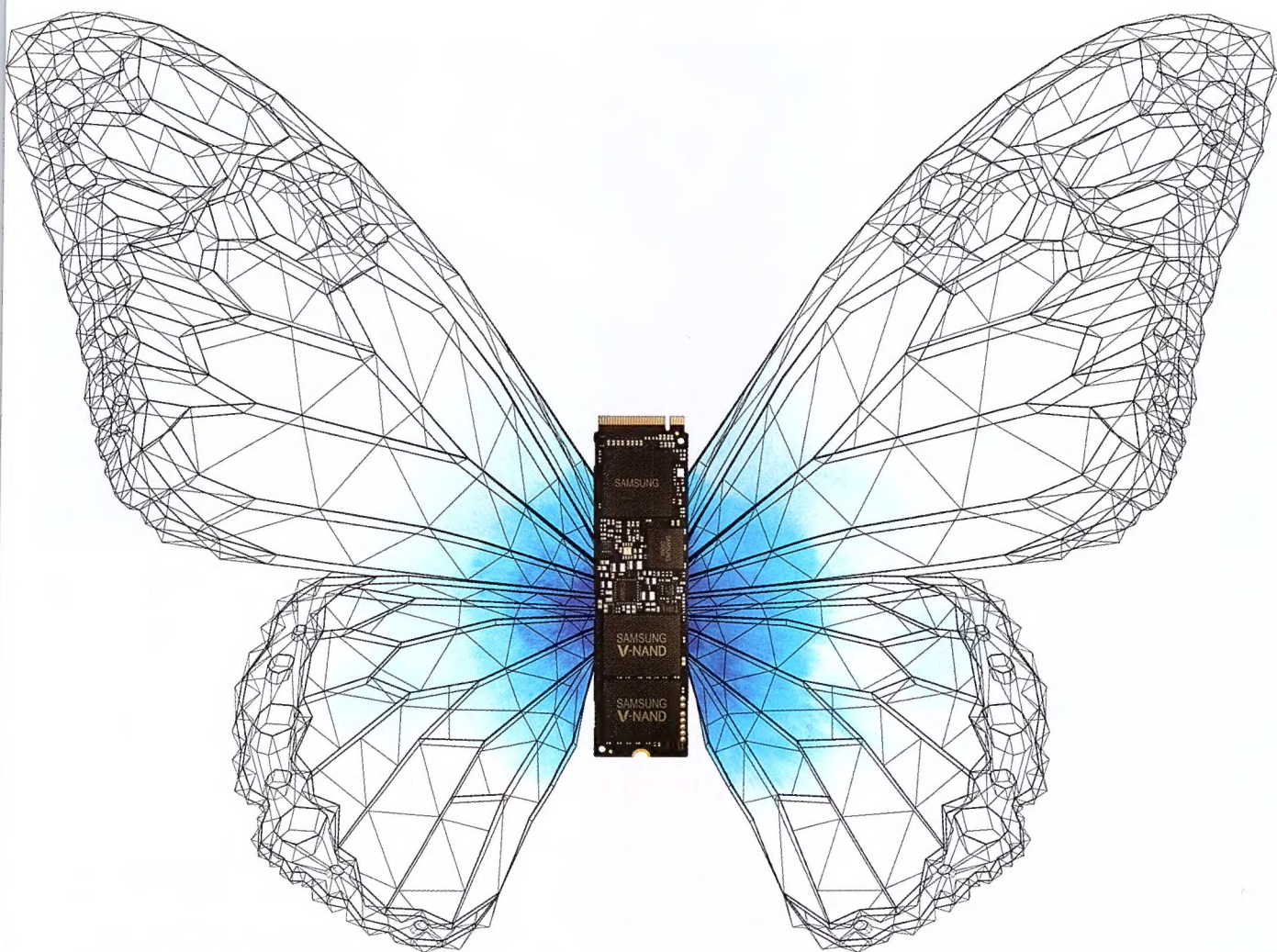
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In irony of ironies, Adblock Plus now selling ads

WHERE DO WE SIGN UP FOR AN AD BLOCKER-BLOCKER?

Popular browser extension Adblock Plus has announced that it has started its own ad network called Acceptable Ads Platform, or APP. "The Acceptable Ads Platform helps publishers who want to show an alternative, non-intrusive ad experience to users with ad blockers by providing them with a tool that lets them implement Acceptable Ads themselves," says Till Faida, co-founder of Adblock Plus. SL

Facebook joins group to stamp out fake news stories

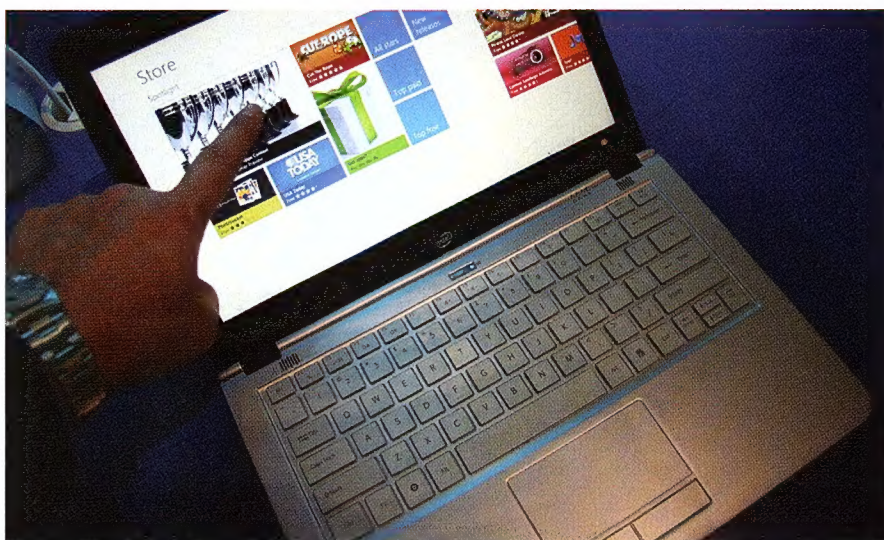
TWITTER'S ONBOARD, TOO.

Having been criticised for allowing fake news stories and misinformation to spread through its social network, Facebook has recently joined the First Draft Coalition — a group of over 30 companies (including Twitter) that share the common goal of improving the quality of information on social media and stamping out trashy articles. The coalition says its platform will be ready by the end of October 2016. SL

Aussies saying "no, thanks" to higher-speed NBN plans

THEY DON'T FEEL THE NEED FOR SPEED, APPARENTLY.

Super-fast broadband was always the biggest selling point of the National Broadband Network, but it appears that most customers are choosing to sign up to its second slowest plan. According to data released by the NBN Co, 49% of customers have chosen the 25Mbps download and 5Mbps upload option, with only 14% choosing the fastest package available, which offers 100/40Mbps. SL



AU Government will block online stores that don't collect GST, report claims

Why you need a VPN, reason #384.

According to the non-profit consumer watchdog organisation Choice, the Federal Government could be eyeing a legislative loophole that would allow it to block access to overseas retailers' websites if they fail to collect Goods and Services Tax (GST) on purchases under \$1,000. As pointed out by Choice, new regulations introduced last year require "overseas businesses with an Australian annual turnover of \$75,000 or more to collect GST on all goods, including those under the current \$1,000 low-value threshold (LVT)". Set to be implemented next July, the rules intend to eliminate any unfair advantages foreign retailers might have over local retailers. An anonymous Treasury official told Choice that the government would first politely ask overseas businesses to comply with the new rules. Failing that, the government would then apply a "compliance mechanism" that would see it use its powers to block rogue retailers as a "last resort". The Treasury expects the measure to bring in \$300 million in GST revenue over the next three fiscal years. Stephen Lambrechts

Printer DRM goes bad, again

HP BLOCKS THIRD-PARTY INK IN THOUSANDS OF ITS PRINTERS.

We've heard about digital rights management (DRM) for music, movies and software, but what about for ink? An HP firmware update from March this year has come into effect that now prevents owners of HP OfficeJet, OfficeJet Pro and OfficeJet Pro X printers from using ink from third-party vendors. According to BBC News, the update reportedly set a timer in its customers' printers counting down to the day that HP's printers would only communicate with its own chipped cartridges. HP says it implemented the update to "protect HP's innovations and intellectual property". Needless to say, customers are unhappy — Dutch ink vendor 123ink says it received over a thousand customer complaints within a single day, citing error messages such as "cartridge problem" and "older generation cartridge". Speaking to the BBC, HP said that its printers "will continue to work with refilled or remanufactured cartridges with an original HP security chip". Seems like a solution that's more trouble than it's worth, if you ask us. Stephen Lambrechts



It's the bomb

SAMSUNG'S GALAXY NOTE 7 GETS RECALLED WORLDWIDE DUE TO OVERHEATING ISSUES.

Samsung has officially announced that it's taking the "proactive and voluntary step" of recalling all Samsung Galaxy Note 7 units globally, following a number of reports in which the flagship phablet suddenly caught fire while charging. Customers can opt to receive a new Galaxy Note 7 (and a courtesy device until replacement Galaxy Note 7 stock arrives) or a full refund. **SL**

Oculus Rift finally gets motion controllers

DON'T EXPECT THEM TO BE CHEAP, THOUGH.

VR pioneer Oculus has finally lifted the lid on its long-awaited Touch Controllers, which will allow the Rift headset to finally utilise 'room-scale' VR games and apps — an ability the competing HTC Vive headset has had since launch. At a price of US\$250 (\$325 for Australian VR fans), however, those new controllers aren't exactly cheap. Once you factor in the US\$780 cost of the headset itself (with shipping to Australia), the Oculus Rift comes very close to losing the lead in price it had over the HTC Vive. **SL**



So it's PlayStation vs PC now?

Sony says its new PS4 Pro aims to woo PC gamers.

Exclaiming what you probably already knew, Sony Interactive Entertainment CEO Andrew House has very clearly laid out the company's intentions to *The Guardian* regarding its upcoming PS4 Pro console. "There's a dip mid-console lifecycle where the players who want the very best graphical experience will start to migrate to PC, because that's obviously where it's to be had," said House, also stating that the company "wanted to keep those people within our ecosystem by giving them the very best and very highest [performance quality]". As to whether the PS4 Pro is also Sony's answer to Microsoft's Xbox Project Scorpio, which is set to arrive next year, House said that "when Playstation 4 Pro was being conceived, there wasn't a word about Project Scorpio in the marketplace". If it's Sony's intention to bring PC gamers back to the living room, then it may have its work cut out for it by releasing a console that will be significantly underpowered by the time the 4K-native Xbox Scorpio arrives. **Stephen Lambrechts**

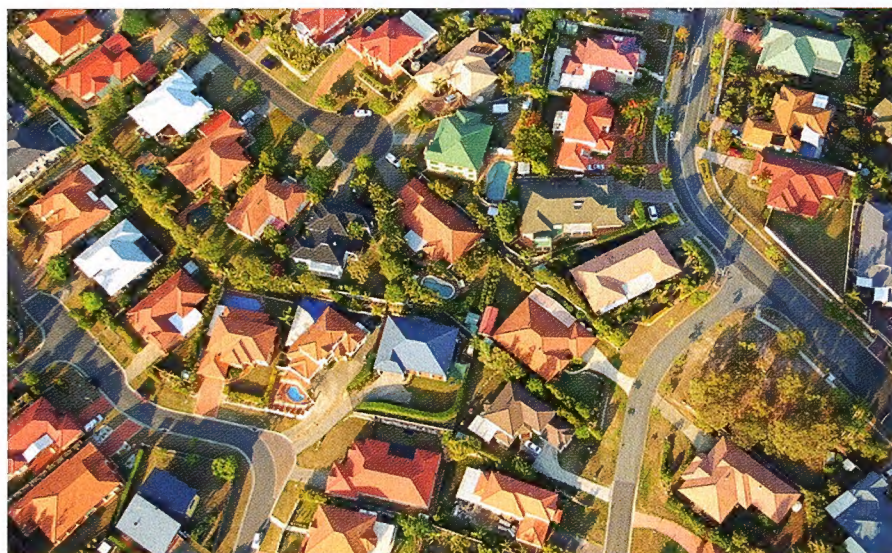
Employers increasingly vetting job applicants' online profiles

BE CAREFUL WHAT YOU POST ON SOCIAL MEDIA.

According to a new study published on the *Human Resource Management Journal*, it's becoming increasingly common for employers to peruse the online profiles and social media accounts of job applicants without their knowledge. The practice, which has been dubbed 'profiling', has reportedly become part of official policy at 55% of the world's organisations. This allows employers to judge potential workers based on things that have nothing to do with their qualifications, like their appearance, interests and lifestyle choices. Academics from the Queensland University of Technology have questioned these practices, objecting to the unauthorised use of employees' publicly available information and suggesting that it robs them of their right to privacy. The study states that 60% of employees believe their employers should not be allowed to access their online info, citing that they should be able to maintain a sense of online privacy. The other 40% surveyed said they tend to practise self-censorship, keeping their employers in mind whenever they post to social media. **Stephen Lambrechts**

technotes

» CARMEL SEALEY LOOKS AT THE NUMBERS DRIVING THE BIG TECH NEWS.



3 MILLION

THE NUMBER OF PREMISES WITH NBN ACCESS AS OF AUGUST 2016.

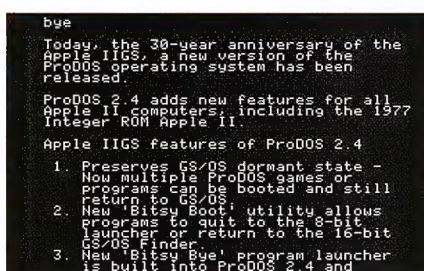
Despite the fact that Labor has attacked the NBN for being behind, August saw Turnbull's NBN reach the impressive milestone of 3 million premises. The Minister for Communications, Senator Mitch Fifield, said that the NBN was "ahead of schedule and on-budget" and is hoping to become available to 9 million premises by the end of the financial year in 2018.



US\$999

HOW MUCH THE FIRST DIY SELF-DRIVING CAR CONVERSION KIT WILL COST, WHICH IS SET TO ARRIVE THIS YEAR IN THE US.

The Comma One is the debut product from automotive AI startup Comma.ai. Essentially an add-on that turns your car into a self-driving gadget, it will cost just US\$999 (about \$1,325), plus US\$24 (\$32) per month to use the software. However, this apparently does not magically turn your car into a fully self-driving vehicle, rather a system that is "about on par with Tesla's Autopilot", according to the company's founder George Hotz. The company aims to ship its product before the end of the year.



23 years

THE TIME IT'S TAKEN TO UPDATE THE OS FOR THE APPLE II COMPUTER.

In mid September this year, on the 30th anniversary of the Apple II GS, software developer John Brooks released the first updated OS for the Apple II computer since 1993 — 2.0.3 was previously the latest update, 23 years ago. Brooks' new operating system, the ProDOS 2.4, includes a menu-based file navigation program called Bitsy Bye, which amazingly runs on less than a single kilobyte of RAM. So if you've got an Apple II lying around, perhaps it's time to power her up again.



25%

THE PERCENTAGE OF GALAXY NOTE 7 DEVICES EXCHANGED IN THE US.

Mere weeks after the phone's launch, Samsung announced the recall of the Galaxy Note 7 due to fears of exploding batteries — despite the fact that less than 0.1% of those sold had the problematic battery issue. The replacement Note 7 phones are now beginning to ship worldwide, but apparently a mere 25% of those purchased in the US have been exchanged for stand-in devices. Optimism, ignorance or arrogance? We're unsure.



52%

THE NUMBER OF AUSTRALIANS WHO THINK THEIR JOB WILL BE IMPACTED BY AI IN THE NEXT 10 YEARS.

With the rise of artificial intelligence comes the inevitable fear that humans will become less attractive to a prospective employer in the job market. 52% of Australians surveyed by Hays recruiters believe that their job will be impacted by AI in some capacity over the next 10 years, from self-serve checkouts to non-routine jobs enhanced with software chatbots. Hopefully, we can keep the bots at bay in the media, though... I like this job!

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ULTIMATE HOME SERVER

**Nov 2005
Issue 454**

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the
» LATEST REVIEWS



Gigabyte P57X v6

A speedy laptop that's taken a bite from Nvidia's latest desktop GPUs

It's safe to say we were excited to get our hands on the NVIDIA GeForce GTX 1070 here in the APC labs, not just because it's a hulking great 17-inch gaming laptop, but because it's the first we've seen to feature an Nvidia GeForce 10-series GPU. That's not just a cut-down version of the GTX 1080, the GTX 1070 features the full version of the GTX 1070, the same as you'll find in NVIDIA's desktop cards. Natural, right?

Not so much. We're expecting big things from NVIDIA's latest line of cards. In a laptop setting, but in a desktop setting, too. We're prepared to say just how much of a performance boost the GTX 1070 offers. From the specs sheet, this thing looks like it's going to perform more than an iterative upgrade; we're at a loss to think of a configuration that would outperform it. And what's in the PS7X and we're inclined to believe that the company's restraint has led to this laptop's exceptional

As mentioned, the PSX7 v6 is a plus size laptop, with a 17-inch screen, a black plastic trademark black plastic exterior and fluoro orange speed stripe trimmings—features that make it stand out amongst GIGABYTE's other gaming laptops. The casing isn't the only area GIGABYTE is playing to its strengths. The PSX7 v6 sports a Pentium 4 and tested 25GB SSD and ITB HDD storage combo, a Intel Core 1060P LCD screen and the category standard 150W 6-7.5V/10A PSU, meaning that much of what makes up the PSX7 v6 has been seen before. Despite the laptop being slightly thinner than we'd expect from a 17-inch gaming unit, it weighs in at a manageable 3.2kg. These specs would make the PSX7 v6 a strong unit at this price, but we guess when you've upgraded your star player there's no real point in looking for a rest of the team. And what a start that is!

When testing a new gaming laptop, we generally

previously tested models against the newcomer. But the GeForce 7300 was yielding every gaming result of the Gigabyte P34W v5 that we tested in April this year. In fact, we needed to put it against something that was more grungy. That said, even when pitted against the high-end console-like PC graphics card, the GeForce 7300 Alpha, which included an additional GTX-980 Ti in the latter's optional Graphics Amplifier add-on, the GeForce 7300 topped the floor with it. The Alpha banged out an impressive average of 82fps on the GeForce 7300's benchmark. That's nearly double the Knight benchmark with the detail settings at Ultra, but the P57K v6 made that look positively tame when it came to the GeForce 7300's framerate of 113fps. This trend continued across all the gaming benchmarks we performed, with the P57K v6 coming in at 100fps, outpacing the Alpha and its Graphics Amplifier unit. Both Nvidia's iD-series

generation Core i6A (AKA Skylake) processors offer a decent reduction in power consumption compared to their forebears, too, so despite the PS7X v6s' exceptional performance, it doesn't have the battery life that you might expect, lasting 2 hours and 51 minutes in everyday tasks. It's also relatively quiet in terms of fan noise, plus the GPU doesn't get above 72°C (with the CPU capping out at a still-tolerable 78°C).

This exceptionally well-rounded machine really feels like the pinnacle of affordable gaming laptops right now. So, Joel Burgess

Verdict

Features	★★★★
Performance	★★★★
Value	★★★★

A well-rounded and astonishingly high-performing laptop that gets very close to taking a few top performance



Logitech G Pro Gaming Mouse

The Logitech G Pro Gaming Mouse is a high-performance, wireless gaming mouse designed for professional gamers. It features a sleek, ergonomic design with a textured grip and a variety of customizable buttons. The mouse is powered by a USB receiver and offers a long battery life. It is available in black and blue colors.



SteelSeries
Siberia 350

Siberia 350 is a professional headset designed for gamers and professionals alike. It features a large, comfortable ear cup with a soft, padded interior. The headband is adjustable and also features padding. The headset is connected via a coiled cable. The SteelSeries logo is visible on the side of the ear cup.

Inside APC

Find out all about APC's editorial policies, test practices, how to read the benchmark results and more.

APC is Australia's oldest consumer technology magazine — having been consistently in print for over 35 years, since our first issue way back in May 1980 — and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer — it's in our name, after all — the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech too, from smartphones and apps to peripherals, accessories, online services and beyond. We have two main goals: to track down the best of modern tech and also to help our readers make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And like you, APC's journalists want to know what's good in tech — no matter what platform it resides on.

INDEPENDENT REVIEWS

Championing technology doesn't mean we're unrelenting yes-men, however, and APC aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three.

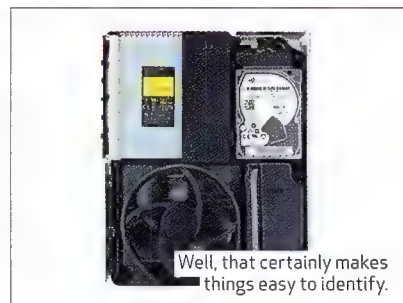
As a matter of policy, reviews published in *APC* are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an *APC* reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

LABS TESTING

Despite being a small magazine with limited resources, APC still strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance, gaming and battery life.

In most cases, for the benchmark results published in APC, you can assume that higher is better. There are certain tests that deviate from this rule and where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter are our preference due to their ease-of-readability, but tables are more compact, so we use these in cases where thoroughness is preferred.



The new Xbox One certainly should be an easy fix — most of the time.

- Spec-bumped GPU supporting HDR10, along with the same AMD Jaguar eight-core SoC found in the original Xbox One
- 2TB of storage (500GB and 1TB configurations are coming)
- HDMI 2.0a connectivity with support for 4K video at 60Hz
- Internal power supply
- IR blaster
- Fancy vertical stand (2TB model only)
- Redesigned Xbox Wireless Controller

■ We take a moment to reminisce about our old Xbox 360 Opening Tool, but decide our trusty iFixit Opening Tool would be of more use. Well, Tools — popping that plastic ‘security’ nub takes a little extra oomph. After some intense prying, we remove the bottom cover, revealing a metal interior case. These clips may be tough at first, but plastic is bound to bend or break, unlike a reusable screw. Next time you open your One S, it may not clip back together.

- Much like the RF board on the Xbox One, the front panel board of the Xbox One S detaches outward from the lower case. With the front panel board's EMI shield removed, we spy a lone IC and some of its friends.
- Next up on the teardown chopping block is the Wi-Fi board. After removing a few Torx screws, it comes quietly, just like the front panel board before it. This is a nice incremental improvement over its location in the previous Xbox One—it makes for one less step to open the inner metal case. Wi-Fi is handled by a MediaTek MT7612UN (most likely a variation of the MT7612U 2x2 802.11ac Wi-Fi module).
- A springy, X-shaped bracket secures the heatsink to the motherboard—a signature part we've seen in every

Xbox since the original 360. The 'X' is a bit fussy, and takes some muscle, but some practiced prying with a flathead driver saves the day.

- **Repairability Score:** 8 out of 10 (10 is easiest to repair). Only a few tools are required to take the whole console apart. Once inside, a clean, no-nonsense modular design allows the drives, fan, heatsink, PSU, wireless board and front daughterboard to be easily replaced. Fewer interlocking body panels and a simpler clip arrangement make opening this generation of Xbox easier than its predecessor. Replacing the hard drive will require both voiding your warranty and some difficult hackery to make it serviceable, though. ■

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit www.ifixit.com.

technotes

» GEAR WE WANT

HP PAVILION WAVE

The new wave of desktop computing?

AU PRICE TBC (FROM US\$550) | STORE.HP.COM

Chances are you've seen images of this new device from HP floating about the web, but you'd be forgiven for thinking that the company had launched a Bluetooth speaker rather than what the Wave actually is: a compact desktop PC. The most striking feature of this discrete mini-PC is undoubtedly HP's partnership with Bang & Olufsen, with the latter designing the exterior facade and, obviously, the inbuilt speaker. But there is plenty more inside to get excited about — this stylish cylinder will be home to a sixth-generation Intel Core processor, up to 16GB of RAM, an (optional) AMD R9 M470 graphics chip and either a 128GB PCIe SSD or a 1TB HDD. **JB**



MOMENT

A haptic wearable that might make you feel better.

US\$179 | WWW.WEARMOMENT.COM

Shantanu Bala is an Arizona State University graduate who's spent six years studying the applications of wearables that use haptic feedback and, based on that, decided to develop a smartwatch that interacts solely through a tactile interface. Instead of telling you the hour of the day, this smartwatch vibrates in a clockwise fashion to help you monitor the passing of time for productivity tracking in work and exercise. An inbuilt metronome should also help musicians keep the beat, and unique rhythmic pattern vibrations can be configured to quietly identify incoming callers. On top of that, tactile directional feedback can be used in conjunction with your phone's GPS to give you directions. **JB**

FITBIT CHARGE 2

Supercharge your fitness tracker.

\$250 | WWW.FITBIT.COM/AU

Fitbit's revamped Charge 2 takes the best bits of the popular Charge, Charge HR and Alta fitness-trackers and combines them into a sleek smart-band. Adding the company's trademark PurePulse heart rate monitoring and drawing from the GPS tracking in your phone, the device can now give you deeper insights into your exercise through mapped periods of cardio and fat burn across 13 different specific sports modes. Add to this a convenient vertically-oriented screen that's four times larger than its predecessor's, alongside a five-day battery life and you have a well-rounded fitness tracker that'll help keep you in shape. **JB**





LOGITECH POP HOME SWITCH STARTER SET

A versatile smarthome device button.

AU PRICE TBC (US\$99) | LOGITECH.COM

Logitech is taking the Harmony Hub home technology control further with its POP buttons, which are simple, big buttons you can press to trigger your smarthome devices to do various things. They work with a range of accessories, including Philips Hue, Belkin WeMo switches and Insteon's full home automation systems. Each button is battery powered and connects to the POP Bridge, which actually sends commands to the devices. Each button can be programmed with three different actions, which are triggered by how you press it: once, double-press, or press and hold. Each of these can trigger an elaborate automation setup, including connection with the Harmony Hub. The starter set includes the bridge and two buttons, but you can buy more to dot around the home.

PAWBO CAMERA

A security camera for your furbabies.

US\$199 | PAWBO.COM

We've seen plenty of security cameras and baby monitors in recent months, but the Pawbo is the first one we've looked at that's specifically designed for keeping an eye on your pets. It's expensive, but along with a 720p video camera, the Pawbo Camera has a speaker and a microphone, so you can talk to your pets when you're away from home (or really confuse them). You can also play games using its built-in laser pointer, and there's even a little tray that dispenses treats to keep your furry friends happy.



SPHERO BB-8 DROID WITH FORCE BAND

Use Force gestures to command your droid.

DROID, \$250; BAND, \$138; COMBO, \$350 | WWW.SPHERO.COM/STARWARS/FORCEBAND

The Force Awakens was released last December to the delight of many millions of fans, but not before the original BB-8 Droid by Sphero became available. You can control him using an app on your phone, but a new gadget has emerged that will rouse the Force within. BB-8 can now be controlled using a wristband named the 'Force Band' and its accompanying app. The plastic band feels a bit cheap, but its design looks thoroughly authentic to the Star Wars universe. The menu is read out by an Obi-wan-alike, and offers the ability to control BB-8 with gestures, such as Force Push and Force Pull. The gyro is quite sensitive and BB-8 responds well to direction and speed commands. ■



technotes

» EPINIONS



"I did some Googling and discovered the cheaper brother (AS5004T) at about \$550. No 4K video, but I don't have a 4K screen anyway."

THE NICEST NAS

It's been a while since I bought an issue of APC, but a recent drive failure at home plus 'Storage Megaguide' plastered on the front of the September issue made it a good purchase.

The local Minister of Domestic Harmony likes her YouTube shows, so I was quickly drawn to the only NAS listed with HDMI plus S/PDIF: the Asustor AS6104T, listed at \$679. (See APC 432, page 48.)

I did some Googling and discovered the cheaper brother (AS5004T) at about \$550. No 4K video, but I don't have a 4K screen anyway. Instead, I have a projector (no sound) and an old amp with a spare S/PDIF input.

There are simply too many NAS variants out there to expect them all to appear in an article, but your broad section let me see which company had products most suited to my needs, and take it from there.

Alan Campbell

Ed replies: Thanks for the kind words, Alan — the NAS market is indeed a rather 'healthy' one these

days; lots of people seem to be catching on to how advantageous they can be in our device-saturated households. Glad you found one that suits your needs — we actually did review (and recommend) that older Asustor AS5004T model back in our July 2015 issue, so you've serendipitously still made an APC-approved choice!

LINUX IS ALL ABOUT THE APPS

In reply to Timothy Whitworth's letter in the October issue (see 'Tell me Linux is great (please)!' in APC 433, page 16) — Timothy, Linux is great, and you're wrong to doubt that there's something 'just off' about it. But I think you may be confusing Linux and the software that runs on it, just like Windows is different from all the other software Microsoft sells.

My wife's Windows 10 system runs all open/free software — the Firefox web browser, Thunderbird for email, OpenOffice for word processing and so on — just like my Ubuntu Linux system does. Okay, I also slip in the Chromium browser. Occasionally, we have to ask someone to send us a document in RTF

rather than some proprietary DOCX/Q/? format; it only takes one ask, normally. Files we send are always readable on Windows systems, because they're standards-compliant. Bottom line — is it Linux or Windows, or just what you're trying to do with it that's making you have doubts?

Peter Ellis

MAGAZINE INDEX

I am a satisfied subscriber to APC, but I wanted to ask if there was an index of articles/tests that have been published in the magazine? It's very time-consuming going through old copies trying to find an article of interest.

Craig Smith

APC Chief Sub-Ed replies: We've had a few people ask the same thing recently and so we're currently in the process of creating a database. We're trying a couple of different types to see which one works best for us and also is easiest to use for readers. Once we've determined which system is the best, we'll announce when it's up and ready to go on this letters page! ■

APCMAG@FUTURENET.COM

Come on, have your say!

We want to hear what you think. Add to these discussions or email your views (in fewer than 250 words) to apcmag@futurenet.com. All correspondence becomes the property of APC and is subject to editing. Letters must include full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.



Goodbye, Jack, we hardly knew ye

Apple's iPhone 7 '3.5mm-gate' sends old headphones to landfill and Shaun Prescott wonders who'll take responsibility.

Apple's decision to remove the 3.5mm headphone jack from its new iPhone 7 has been the subject of much hand-wringing and debate. Some consider it an unambiguously bad decision, while others prefer to frame it as another 'brave' move on Apple's part to drag us consumers (reluctantly) into the future. Apple notoriously stated that 'courage' was the reason for the jack's demise and, historically, the company does have a penchant for courageously removing seemingly sacred features from its devices: optical drives are no longer standard in MacBooks, and even USB ports have become scarce on its latest laptops, too. But has Apple made the wrong decision this time?

Whatever the implications regarding the iPhone 7's sales (and I dare say it probably won't make much difference), consider this: every person you know probably has at least one set of headphones with a 3.5mm jack. I own at least three, and that's likely the case for many others, too. Sure, manufacturers can marginally improve audio fidelity by using a USB Type-C plug or, as Apple has done, a Lightning connector, but for a generation reared on low-bitrate

streaming services, who cares anyway? And while removing the 3.5mm plug will reduce the size of the phone by a small fraction, or free up space for some other things, that's hardly a worthwhile payoff if the result renders your headphones useless.

Yes, we've read these arguments before — every consumer-tech writer has posited them these past few weeks. But if Apple is right and the 3.5mm plug needs to go, what's going to happen to the headphones? Sure, there will be adapters — there's even one included with the iPhone 7 — but that doesn't mean the death knell hasn't sounded. At the behest of Apple, the 3.5mm plug (and all the headphones that bear one) will soon be gone. Will Apple take responsibility for the environmental chaos this will wreak?

It's not often discussed when talking of superceded technologies — we prefer to discuss the functional, face-value pros and cons of an evolution — but as the world hurtles towards climate catastrophe, and as waste-disposal for electronics becomes a despairingly huge problem, is it such a good idea to supercede technology when the benefits are so marginal?

In March, Apple announced that in addition to a sustainable forestry initiative and its moves towards renewable energy, it had developed a 29-armed robot named Liam, designed to dismantle old iPhones and recycle their constituent parts. It's a decent initiative, but one that would be less necessary if planned obsolescence wasn't baked into pretty much every device Apple has issued in the past decade. And Apple isn't alone in recklessly selling us iterative technology at the expense of the environment: Sony and Microsoft have just started doing it with their respective 'mid-cycle' gaming console upgrades, and the computer industry has long churned through disposable tech on a nigh yearly basis.

But if a company wants to have a respectable environmental policy, then it needs to consider how its "disruption" and "innovation" will spawn an influx of e-waste into an already bursting-at-the-seams (and abhorrently polluted) China. Apple may have internal recycling initiatives for its own hardware, but will it take responsibility for all the waste that will ensue from a significant change to its devices? ■

END USER

Share your stories!

If you have an interesting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at apcmag@futurenet.com. All correspondence becomes the property of APC and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

the lab

» LATEST REVIEWS



GAMING LAPTOP

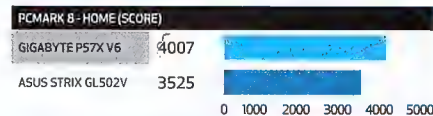
\$2,799 | WWW.GIGABYTE.COM.AU

Gigabyte P57X v6

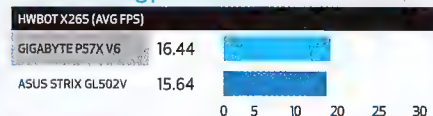
A speedy laptop that's taken a bite from Nvidia's latest desktop GPUs.

LABS BENCHMARK RESULTS

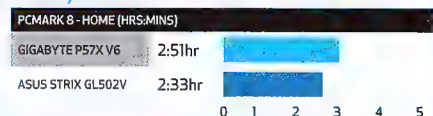
General performance



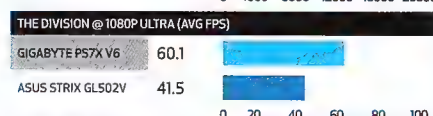
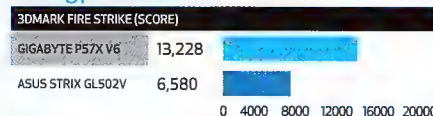
Media encoding performance



Battery life



Gaming performance



It's safe to say we were excited to get our hands on the P57X v6 here in the APC labs, not just because it's a hulking great 17-inch gaming laptop, but also because it's the first we've seen to feature an Nvidia GeForce 10-series GPU. That's not just a cut-down 'mobile' GPU either; the P57X v6 features the full version of the GTX 1070, the same as you'll find in Nvidia's desktop cards.

Naturally, we were expecting big things from Nvidia's latest line of cards in a laptop setting, but nothing could have prepared us for just how much of a performance boost the GTX 1070 offers. From the specs sheet, this might seem like nothing more than an iterative upgrade, yet we're at a loss to think of a configuration that would be better than what's in the P57X and we're inclined to believe that the company's restraint has led to this laptop's exceptional performance.

As mentioned, the P57X v6 is a plus size laptop, with a chassis using Gigabyte's trademark black plastic exterior and fluro orange speed-stripe trimmings – the same look that prevails amongst Gigabyte's other gaming laptops. The casing isn't the only area Gigabyte is playing to its strengths, though, harnessing a tried and tested 256GB SSD and 1TB HDD storage combo, a glossy IPS 1080p LCD screen and the category-standard Intel Core i7-6700HQ CPU, meaning that much of what makes up the P57X v6 has been seen before. Despite the laptop being notably thinner than we'd expect from a 17-inch gaming unit, it weighs in at a manageable 3.2kg. Those specs would add up to an average result at this price, but we guess when you've upgraded your star player, there's no real pressure to change the rest of the team. And what a star that is...!

When testing a new gaming laptop, we generally compare benchmarks of

previously-tested models against the newcomer. But with the P57X v6 doubling every gaming result of the Gigabyte P34W v5 that we tested in April this year, it was clear we needed to put it up against something with a bit more grunt. That said, even when pitted against the high-end console-like PC from Alienware known as the Alpha, which included an additional GTX 980 Ti in the latter's optional Graphics Amplifier add-on, the P57X v6 still wiped the floor with it. The Alpha banged out an impressive average of 82fps on the tough *Batman: Arkham Knight* benchmark with the detail settings at Ultra, but the P57Xv6 made that look positively meagre when it managed an average framerate of 113fps. This trend continued across all the gaming benchmarks we performed, with the P57X v6 either equalling or outpacing the Alpha and its Graphics Amplifier unit. Both Nvidia's 10-series GPU's and Intel's 6th-

generation Core (AKA Skylake) processors offer a decent reduction in power consumption compared to their forebears, too, so despite the P57X v6s exceptional performance, it doesn't have the brief battery life that you might expect, lasting 2 hours and 51 minutes in everyday tasks. It's also relatively quiet in terms of fan noise, plus the GPU doesn't get above 72°C (with the CPU capping out at a still-acceptable 83°C).

This exceptionally well-rounded machine really feels like the pinnacle of affordable gaming laptops right now. **Joel Burgess**

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

A well-rounded and astonishingly-fast gaming laptop that gets very close to desktop-level performance.



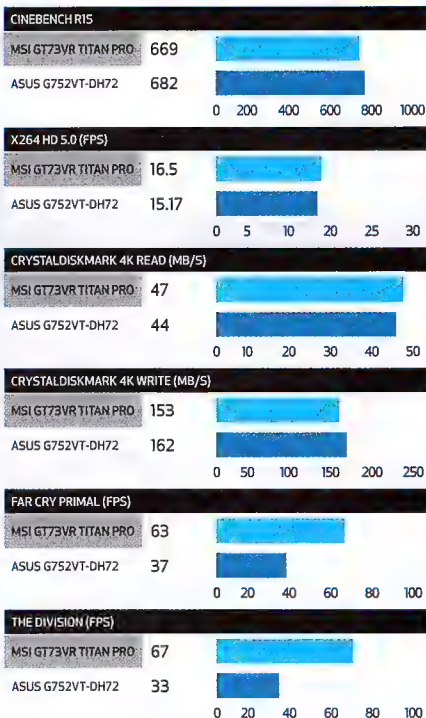


GAMING LAPTOP

\$4,999 | AU.MSI.COM

apc
RECOMMENDS

LABS BENCHMARK RESULTS



MSI GT73VR Titan Pro

Nvidia's awesome GTX 1080 gets another run in a portable package.

There's mobile graphics, and then there's proper gaming graphics. For a taste of the latter in a portable package, look no further than MSI's new GT73VR Titan Pro. It's a beefy 17-inch portable with Nvidia's stupid-quick GeForce GTX 1080 graphics.

That GPU is just the beginning of what is an epic feature set. There's a quad-core Intel Core-i7 6820HK CPU, which clocks in at 2.7GHz nominal and 3.6GHz Turbo. Next up, MSI has stuffed in a pair of 256GB Samsung PCIe SSDs running in RAID 0, plus a 1TB 7,200rpm magnetic drive, and a posterous 32GB of RAM.

Then there's support for 120Hz refresh on the 1080p panel (a 4K panel is available optionally), a backlit keyboard from SteelSeries, and a veritable plethora of ports. The Titan Pro also uses the MXM format for that GTX 1080 GPU, which MSI says allows for a change or repair to your GPU when

needed. MSI also says this feature is not intended for end-users to change the GPU themselves. With most laptops, you have zero chance of upgrading the GPU down the road; with this thing, you at least have half a chance.

The Titan Pro has some serious cooling, speakers from Dynaudio and other detail enhancements, including low-lag Ethernet for super-fast ping. On paper, then, it's absolutely killer. In the flesh, it looks pretty lethal, too. Style-wise, it's a typical gaming laptop, which makes it either suitably aggressive or a little adolescent, depending on your preference. At about 3.9kg, it's just transportable.

The SteelSeries keyboard certainly adds a little colour and a stable input platform, though it's worth noting that the soft tactility of the keystroke is nothing like a mechanical desktop keyboard. The 17.3-inch 1080p display, meanwhile, is something of a mixed bag.

The rendering is gorgeously smooth, thanks to that 120Hz ability, the colours and contrast are also reasonable, but the viewing angles are merely mediocre.

Performance-wise, this thing flies. The quad-core Intel CPU is a known quantity, of course, but those Samsung SSDs in RAID 0 absolutely scream, pumping out GB/s of raw bandwidth, even if the 4K random access is less spectacular. But what you really want to know is whether that GTX 1080 GPU delivers. In a word, yup. The specs, including core and memory clocks, are almost identical to a full desktop GTX 1080. You probably wouldn't be able to tell the difference in gameplay.

Factor in the modest 1080p display resolution, and the Titan Pro makes absolute mincemeat of our gaming benchmarks. It tears through *Rise of Tomb Raider* at high detail at 98fps, and knocks out over 60fps in *Tom Clancy's The Division*. Even *Far Cry*

Primal, set to full reheat, hits a heady frame rate of 67. Heck, you even get around three hours of real-world web browsing battery life, which isn't bad for this kind of beast.

Set against all that are three provisos. First is the aforementioned girth – this is a massive machine. Second is the build quality. Like pretty much all laptops in this class, the plastic chassis is underwhelming. Finally, there's the price. Suffice to say, it ain't cheap. But if it's maximum gaming performance in a somewhat portable package you want, it might just be worth it.

■ Jeremy Laird

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Stunning graphics performance, massive feature set, some possibility of future graphics upgrades.





LAPTOP

FROM \$1,450; \$2,600 AS TESTED | WWW.HP.COM/AU

HP EliteBook Folio G1

Apple's tiny 12-inch MacBook finally has some Windows competition.

Back in 2015, Apple introduced a new featherweight 12-inch MacBook that still managed to pack in lots of high-end features, including a near full-size keyboard, high-res Retina display and lots of memory and storage space. Up until now, we haven't seen many Windows alternatives.

The Folio shares a lot of commonalities with that Cupertino machine. This is a 12.5-inch unit that, even just from looks alone, has similarities: the silver chassis and black keycaps are very MacBook-like, and the Folio is also a bit light on ports – there are two USB Type-C sockets on the right edge and a headphone jack on the other. One of those USB ports also doubles as the power socket – if you plan on using this one mostly plugged in, you'll definitely want to invest in a

USB hub. Its compact footprint is notably smaller than 13-inch laptops, the carry weight is respectably low at 1.07kg (sans charger) and the build-quality is quite robust. This is a tough little ultrabook with a mostly-aluminium body – there's zero flex in the keyboard and it's quiet thanks to its passive cooling, so there's no fans inside.

That 12.5-inch display uses a gorgeous 4K (aka UHD) panel that's capable of showing off subtle variations in colour and, at this physical size, is exceptionally clean and sharp. The keyboard and trackpad are likewise first-rate – and there's a solidity and dependability to the Folio's physical design that few Windows laptops can match.

HP sent us a nearly top-spec version for this review,

which sells for around \$2,600 online – you can find less-pricey configurations starting at around \$1,500, but they often have 1080p displays and 5th-gen Intel Core M CPUs, rather than the 4K display/6th-gen CPU combo that's used here. At this price, you also get a 256GB SSD for storage and a generous 8GB of memory.

However, despite those high-end specs, there are still some very obvious limits to the Folio. That ultra low-power Core m7-6Y75 CPU is only a dual-core model, which means there's not a lot of processing grunt. While it handles the basics just fine (web browsing, streaming word processing, movies and so on), multitasking can see things slow down to a crawl. Even just tasks like installing Windows updates or running some of our tougher benchmarks take

two or three times longer than a Core i5 laptop.

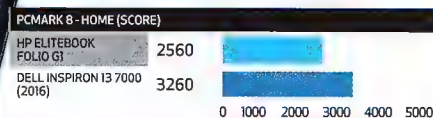
Battery life could also be better, lasting around 3.5 hours in most of our tests. We get the feeling the high-res UHD display and top-drawer Core m7 in our test model are a bit too taxing for the four-cell battery inside – you'll likely fare better with a 1080p display and a lower-end Core m5.

Still, the Folio is very easy to love, if you can handle that 'business class' price.

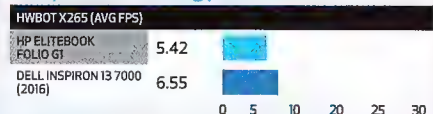
■ Dan Gardiner

LABS BENCHMARK RESULTS

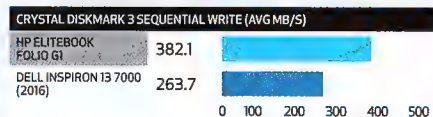
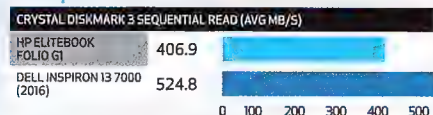
General performance



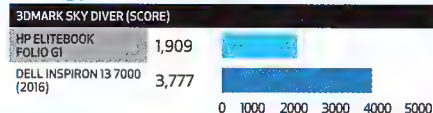
1080p media encoding performance



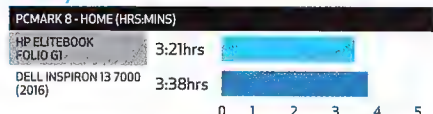
Disk speed



Gaming performance



Battery life



Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

This little laptop is physically first-rate, but be aware of the performance limitations.





INTEL MOTHERBOARD
\$420 | AU.MSI.COM

MSI Z170A MPower Gaming Titanium

How to nail the Z170 chipset.

This motherboard is beautiful, and that's down to a couple of nifty additions, most prominent of which is that suitably succulent shiny silver PCB. Couple that with an extensive aluminium rear I/O cover and a solid backplate, and you're looking at one standout product. A little niche, though, true.

But what about features and connectivity? Well, for a \$420 motherboard, you're completely spoilt. You net yourself access to two (steel-reinforced) x4 M.2 slots, supporting both RAID 0 and 1; three (steel-reinforced) PCIe slots, running at max in x8x8x8; four dual-channel DDR4 (steel-reinforced) DIMM slots for all your crazy memory speeds, all the way up to and beyond 3,866MT/s; and, interestingly, a single U.2 connector located below the SATA ports, for all those Intel PCIe SSDs you're not

buying yet. Why the steel? It does two things: firstly, it strengthens the PCIe brackets, preventing you from causing too much damage to your, err, slots. It also reduces the potential amount of electromagnetic interference from your other components.

As far as performance goes, it's as well rounded as we've come to expect. Processor performance was in line, clocking up 922 points in Cinebench R15 at stock, and 19.39fps in Tech ARP's x264 benchmark – about right for the Intel Core i7-6700K.

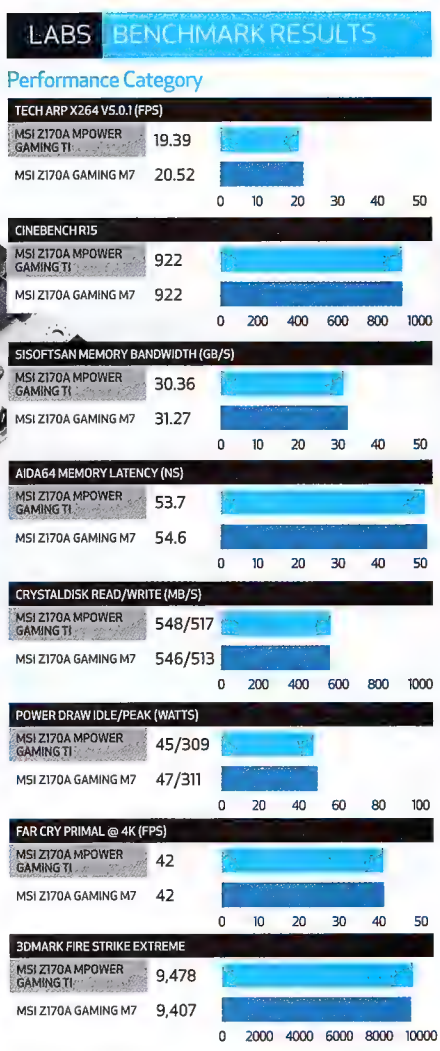
Memory bandwidth was impressive, scoring just over 30.36GB/s in SiSoft Sandra's benchmarks, and the MPower absolutely stomped over the latency tests in AIDA64, scoring an astonishing 53.7ns – far lower than any of the other X99 motherboards or competing brands. As always, gaming was

consistent with every other motherboard ever, scoring the usual 42 frames per second in *Far Cry Primal*, and a nifty 9,478 points in 3DMark Fire Strike.

What was really impressive, though, was the MPower Titanium's overclocking performance. We dialed our 4.8GHz overclock into the BIOS at 1.4V, and then worked backward to see what minimum voltage the MPower could manage before giving up the ghost in stability. The result? 1.38V. That's 0.02V lower than we've seen from the likes of the MSI Z170A Gaming M7, which also reduced overall temperatures by 7 degrees. Sweet as.

Without a doubt, the MPower Titanium has a fantastically rich feature set, and exceptional overclocking performance, stability, and performance, bringing it in line with all the other motherboards

we've ever tested, outside of overclocking. It also looks exceptional, the almost-ubiquitous reinforcement makes it beautifully comfortable to hold, and the added benefit of both U.2 and front USB Type-C makes this motherboard a shoo-in for future-proofing your build. MSI's BIOS still needs a little reworking in our eyes, to make it a bit easier to use, but otherwise, this is a fantastic motherboard, and once you've ploughed through the marketing rhetoric, it's well worth your time. ■ Zak storey



Verdict

Features

★★★★★

Performance

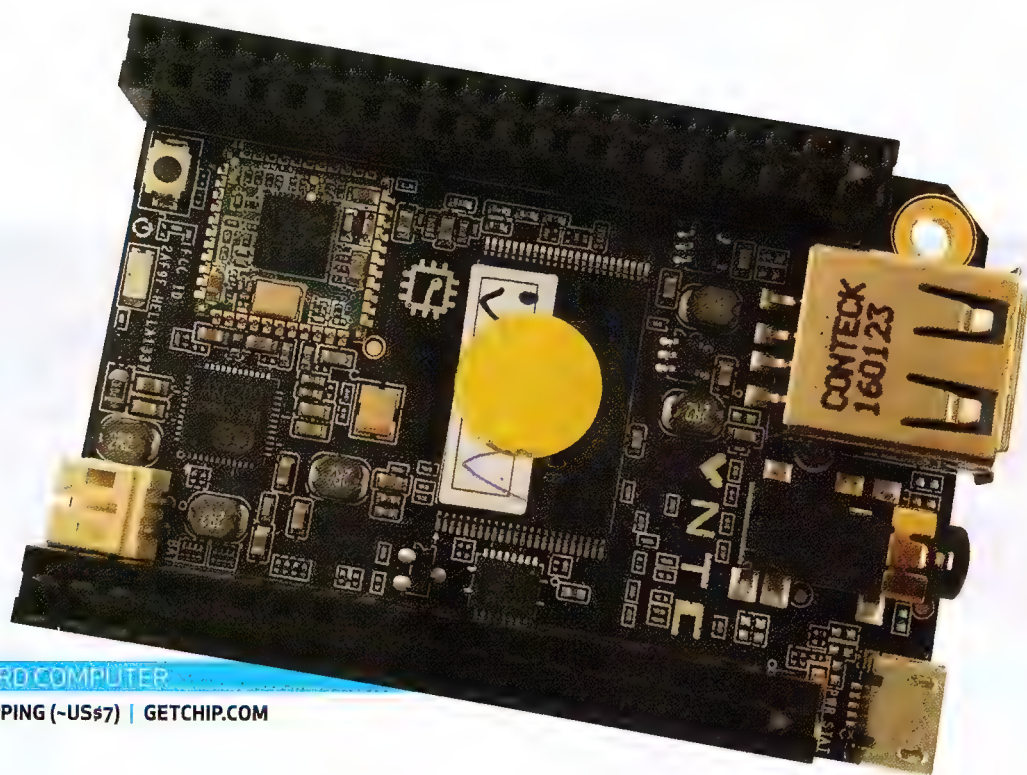
★★★★★

Value

★★★★★

Outstanding overclocking performance, exceptional latency, sturdy, consistent performance, great aesthetics.

★★★★★



SINGLE-BOARD COMPUTER

US\$9 PLUS SHIPPING (~US\$7) | GETCHIP.COM

C.H.I.P.

Les Pounder loves Pi, and loves hacking something to life using the single board computer, so could he be adding C.H.I.P.s to his plate?

Crowdfunding has brought many single-board computers to life and the latest of these is C.H.I.P., a US\$9 computer from Next Thing Co. Measuring 6.1cm x 4cm x 1cm, C.H.I.P. is slightly larger than a Raspberry Pi Zero, with 512MB of RAM and a 1GHz CPU speed, but provided by an Allwinner R8 ARM Cortex A8 CPU.

But what C.H.I.P. provides is extra integrated Wi-Fi (B/G/N), Bluetooth 4.0 and 4GB of flash storage for the OS. The board also comes with a USB 2.0 port, a micro USB for power and a combined audio/video composite jack. But lacks digital video output.

There's an 80-pin GPIO, with some pins that can be user-controlled and others that are bespoke connections, such as connections for PocketC.H.I.P.'s LCD screen. Also present on the board is a JST connector that's commonly used with

Lithium Polymer batteries. It gives an instant portable long-term power supply for embedded projects thanks to an onboard AXP209 power management chip.

Installing the OS is handled via a Chrome browser plugin and requires an extra configuration step for Linux users. When ready, you need to attach your peripherals and power up to the desktop. C.H.I.P. doesn't come with any HDMI or VGA interfaces and requires the user to purchase an add-on board, known as 'dip'. We used the HDMI dip to connect our C.H.I.P. to a screen.

Once loaded, we see an interface similar to Mate's desktop. The interface has a noticeable lag but it's still usable. We installed the htop dashboard and saw that around 70% of the RAM was being used and the CPU was maxed out. This generated a lot of heat, which was enough to make the CPU a little uncomfortable to the touch.

Installing software is possible using the Debian APT packaging tool and the package manager GUI. On first boot, we updated the software to ensure we were up to date, which updated our kernel to 4.4.11 released on May 28 2016.

We installed the Arduino IDE and flashed the blink sketch, the 'Hello World' of hardware, to an Arduino Uno. Compilation was noticeably slower than our Core i5 laptop, but that's to be expected given the C.H.I.P.'s hardware. To test the GPIO, we installed the Python library, which is very similar to that used on the Pi. Within a few minutes, we had the obligatory flashing LED test completed. As part of our test, we installed Open Arena, in order to test the prowess of the Mali 400 GPU. Sadly, this test was short-lived as loading the game menu took a long time and choosing menu options meant a delay of around 1-2 seconds, so it was clear the game would be

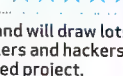
unplayable. Looking on the official forums, it appears as though there's no driver for the GPU, but hopefully, this will be remedied. But is C.H.I.P. a games machine? Not really.

Its closest competition is the Raspberry Pi Zero and for just US\$4 extra, it offers Bluetooth, Wi-Fi and 4GB of storage. This means that C.H.I.P. can be used for embedded Internet of Things applications, and for these applications, it excels. C.H.I.P. is a serious piece of kit for embedded projects and provides everything you need to get going.

■ Les Pounder

Verdict

Features
Performance
Value



Priced competitively and will draw lots of attention from makers and hackers for their next embedded project.





GAMING MONITOR

\$649 | WWW.ASUS.COM/AU

ASUS RoG Swift PG248Q

180Hz gaming has arrived, but do we really want it?

So good it hertz. That's the thinking behind the new 180Hz-capable ASUS RoG Swift PG248Q. The step up from a standard 60Hz LCD monitor to something capable of 100Hz and beyond is pretty sweet. Nearly everything is smoother and slicker. Obviously, games benefit more than just about any other application from a higher refresh. But even bumping application windows around the desktop is more pleasant. Once you've tried high refresh, you won't want to go back.

However, it doesn't automatically follow that chucking ever higher refresh rates at the problem of gaming smoothness makes sense. Eventually, you get to a point where human perception can no longer distinguish the increase. In our experience, the returns fall off beyond 120Hz. Put it this way, it's easy to pick a 120Hz monitor from a 60Hz screen with the

naked eye, but if you had two otherwise identical screens running side by side at 120Hz and 180Hz...? Even if you can see the difference, do you have a graphics card that can generate frames fast enough to benefit from the full 180Hz?

Those are the questions the PG248Q needs to answer, because at \$649, it costs a pretty penny for what, in many regards, is a modestly specced monitor. It's just 24 inches, delivers 1,920 by 1,080 pixels, and is powered by a TN panel. It's also priced perilously close to a couple of ASUS's own RoG Swift monitors with larger 27-inch panels, and 2,560 by 1,440 pixel grids. One of them, the ROG Swift MG279Q, even offers an IPS panel.

This 24-inch model's value proposition only looks weaker when you fire it up. TN technology has come a long way of late, in terms of colours and contrast, but this thing is old-school TN in all the wrong ways. It's fundamentally lacking in

visual pop and contrast. The viewing angles are modest, too, in typical TN style. Meanwhile, our test images reveal noticeable compression in white tones, along with a little banding in gradients.

TN panels don't have to be this bad. Still, offsetting all that is the undeniable performance in terms of speed and response. The PG248Q is rated at 1ms, and it feels good for it. Another obvious plus point, and one that goes some way toward justifying the pricing, is support for G-Sync, Nvidia's proprietary adaptive sync implementation. It's more costly than the FreeSync alternative from AMD, but for now, it's simply better. The PG248Q also supports Nvidia 3D Vision and 3D LightBoost tech, a major boon if you're into 3D stereoscopic gaming.

The top-quality stand, with the full range of height, rotate and swivel adjustments, and the nicely put-together chassis help justify the price, too. The

OSD menu is also full of features, even if the image presets are mostly useless, and the fastest overdrive setting introduces chronic inverse ghosting.

There's lots to like here for gamers. It's a seriously speedy screen, with a long list of desirable features. But you'd have to be awfully confident in being able to perceive the improvement in refresh rate over a 120Hz or 144Hz alternative.

For us, the fact that you have to jump into the OSD menu and enable the 180Hz refresh as an 'overclocked' setting drives home that final nail. It's pure gimmickry. ■ Jeremy Laird

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Super-quick response and refresh; loads of features; quality chassis; but at a cost.





34-INCH CURVED MONITOR

\$1,300 | WWW.LG.COM/AU

LG 34UC88

Broaden your horizons (and your productivity) with LG's affordable curved ultrawide LCD.

It's hard to truly understand how enveloping one of the new breed of ultrawide 21:9 curved monitors can be until you've actually plonked yourself down in front of one. Productivity immediately increases – you find yourself zeroed-in on a given task, with everything else on screen still there, but fading off into your peripheral vision. Then when you do need to multitask, you simply have to adjust your focus to a different part of the screen and, suddenly, your next objective is right there waiting for you. In short, it's like working on two monitors, but way better.

This is the reaction that LG's new 34UC88 monitor inspires, with its vision-engulfing 34-inch curved screen offering an immense amount of desktop real estate – perfect for simultaneously working across multiple large windows in splitscreen or picture-in-picture mode. Displaying at a native

resolution of 3,440 x 1,440 pixels, this IPS monitor is remarkably crisp, with a rich level of detail and colour that also makes it great for gaming. Those with AMD graphics cards will be able to take advantage of FreeSync capability, which allows the GPU to adjust its frame rate on the fly to eliminate tearing and deliver smooth motion in the 55–75Hz range. (Nvidia cards can still get some benefit, but will have to perform at a locked framerate at up to that 75Hz refresh.)

You will need a fairly beefy graphics card to run games at that native '3K' resolution – something like a GeForce GTX 1060 or Radeon RX 480 is what we'd consider the bare minimum if you want to run with all the bells and whistles. If that's within your budget, though, then you'll find that playing a first-person shooter like *Doom* with an extremely-wide view of the level is a literal game-changer – in some ways, we

reckon this is better than VR, as you can get an immediate benefit to your existing games. For the most part, games from the last couple of years will support 21:9 aspect ratios out of the box – barring a few oddities like Blizzard's *Overwatch*, where the developers have decided (wrongly, in our mind) that 'proper' 21:9 support with the requisite expanded field of view (FOV) allows too much of a competitive advantage, so you get a narrower FOV.

The 34UC88 provides a number of genre-specific game modes which can be implemented to optimise gaming visuals and display performance, plus a there's a 'Dynamic Action Sync' option that helps reduce input lag.

In terms of comparative screens, last year's XR341CK from Acer offers very similar specs (it, too, is a 34-inch curved display with a gaming focus and FreeSync support) and can be picked up for roughly the same price. But with Acer's

XR341CK nearly end-of-life and with a shallower curve, this LG is the clear winner if you're looking to pick up a 34-inch in today's market. That said, for those who are willing pay the premium for G-Sync support, the ASUS RoG Swift Curved PG348Q gaming monitor will give users with Nvidia cards proper adaptive-sync support (at refresh rates up to 100Hz) for around \$1,779.

In sum, though, the LG 34UC88 is wonderful for both productivity and gaming, offering a high-quality ultra-wide experience at a price competitive for its size.

■ Stephen Lambrechts

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

There's nothing quite like working (and playing) on an ultra-wide curved monitor, and this is one of the best.





CURVED MONITOR

\$500 | WWW.SAMSUNG.COM/AU

Samsung C27F591FD

Less wide than the LG, but still offers plenty of curve.

While this 27-inch monitor is, like the behemoth LG screen opposite, also a big, curvy beauty, it doesn't take it to quite the same extremes. This is a more sedate screen with an office-friendly while and silver colour scheme, standard 16:9 aspect ratio and a 1080p pixel count, on one of Samsung Super Vertical Alignment panels – a screen tech which delivers most of the benefits of IPS on top of some of its own.

This is one of Samsung's curvier displays – if you mentally extended that curve to form a complete circle, it'd have a radius of 1,800mm; thus, Samsung's '1800R' specification. By comparison, the Korean tech company also offers 3,000R and 4,000R displays – basically, the way to read these specs is that the bigger the number, the gentler the curve. Still, sit directly in front of the C27F591FD and it takes up enough of your

field of view that it doesn't look overly curvy at all – it's just pretty comfortable. The main benefit of curved screens is that they mean your eyes don't have to refocus when scanning across the display, and along those 'eye-friendly' lines Samsung's also included flicker-free tech and a nighttime mode to reduce blue hues... although the latter needs to be enabled manually, meaning it's a bit of a pain to use – it's much more convenient to just install a set-and-forget automatic app like f.lux (justgetflux.com) instead.

The screen has a matte finish – always our preference for PC monitors – and a mild anti-glare coating which is, thankfully, largely free of the 'sparkle' effect that some of these coatings can have. (We're looking at you, Dell.) There's a little bit of gaming DNA in here too, with AMD FreeSync support – although this isn't a high refresh-rate display, which here tops out at the standard

60Hz – if you're after a monitor for lag-free high-framerate gaming, there are much better options, albeit more costly ones.

In terms of colours, Samsung's tuned this one to be quite vibrant, but not so much so that it's oversaturated. Like the Korean tech giant's AMOLED phones, there's a fluorescence and richness here that look especially great with both movies and games.

We do have some gripes, though. That 1080p resolution at a 27-inch panel size means that, at close viewing distances (under about 40cm), pixels can be slightly visible. At a more moderate distance, say 50cm plus, that's less problematic – although ideally, at this size, you really want a resolution of 2,560 x 1,440 to eliminate any visible pixellation.

Moreover, while it might seem cheap compared to the 34-inch LG, this screen does sell for a premium over other 27-inch curved

monitors, which, in Australia, can be had starting from around \$380. (That even includes Samsung's own S27E510C, released mid last year.) And there's certainly some of the Australia tax at work here – in the States, the C27F591FD is only US\$280; a little over half what us Aussies are expected to pay. Even factoring in exchange rates and GST, that's still an AU\$90 premium.

Still, the price will undoubtedly drop on this one over the next few months, and when it gets down closer to the \$425 mark, there's be a lot to love here. ■ Dan Gardiner

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

A pleasingly-curve 27-inch monitor that's just a little too costly. Wait for the price to drop.





KEYBOARD CASE

\$259.95 | RAZERZONE.COM

Razer Mechanical Keyboard Case for iPad Pro

It's for a Pro, but not a MacBook.

Razer is well known for its specialist gaming keyboards and mice, and now it has brought that expertise to the iPad Pro with this mechanical keyboard.

Like its gaming-oriented counterparts, the Mechanical Keyboard Case for iPad Pro is built like a tank – it's very solid, and the upper panel acts as a protective case for the iPad Pro (12.9-inch); it's detachable for use as a case on its own, if you wish to go without the keyboard itself for a time.

The keyboard panel is a bit chunky, but the mechanical keys feel firm and responsive, and we prefer them to most of the thin, flat keyboard covers we've seen. Our only criticism is that the keys can be a bit noisy when you're typing, but that's to be expected from a mechanical board.

There's a set of function keys for iPad features

such as volume, screen brightness, Spotlight and audio controls. Sadly, though, Razer opted for Bluetooth connectivity rather than using Apple's Smart Connector. This is powered by a rechargeable battery that lasts between 10 and 600 hours, depending on your use of the keyboard backlight.

The battery also adds to the weight of the keyboard, which comes to a full 1kg – or 1.7kg with the iPad Pro itself, which is more than a 13-inch MacBook Air!

And at \$259.95, the Mechanical Keyboard Case is the most expensive iPad keyboard we've ever seen, period.

■ Cliff Joseph

Verdict

Extremely comfortable, decent sound, fully adjustable. Not much for price, expensive accessories.



2.1 SPEAKERS

\$449.95 | WWW.CREATIVE.COM

Creative T4 Wireless

The top end of old-school 2.1 speakers.

Opening the box, you're greeted with two small, stylish tweeter satellites, featuring a stunningly polished chrome top, black base and single driver. Although you can't adjust the angle of these two speakers, they're naturally slanted slightly upward, and thanks to their small size, they're easy to position. The aluminium drivers provide a crisp and rich sound, especially with the subwoofer. Music is clear and precise, as you'd expect from a \$450 2.1 speaker system.

The subwoofer is impressive and compact. But don't let its size fool you – the level of bass output is simply astronomical. There's a small dial located at the back of the device to adjust bass levels from 1 to 11; however, in our testing, we found that keeping it at the absolute minimum setting was perfect. Your experience may vary.

Setup is relatively painless – simply position

your speakers where you need them, hide your sub under the desk, then route the cables into the back of the woofer. There's an optical input for HD TVs, RCA-to-analog input for your system and to connect the speakers to the sub. Annoyingly, you can't detach the cables from the satellites, but otherwise there's little to complain about. If your phone has NFC, you can pair the Creative T4 up to the device wirelessly.

Creative really has nailed what a small 2.1 speaker system is all about. For those looking for a compact replacement for a set of cheap studio monitors, these might just fit the bill.

■ Zak Storey

Verdict

Hitting the nail on the head in terms of value for money.





XPLORER V

XPLORER V

Drone Body + 5.8G Remote Controller + 3 Axis Gimbal + 1080P camera + Range Extender



+



+



XIRO

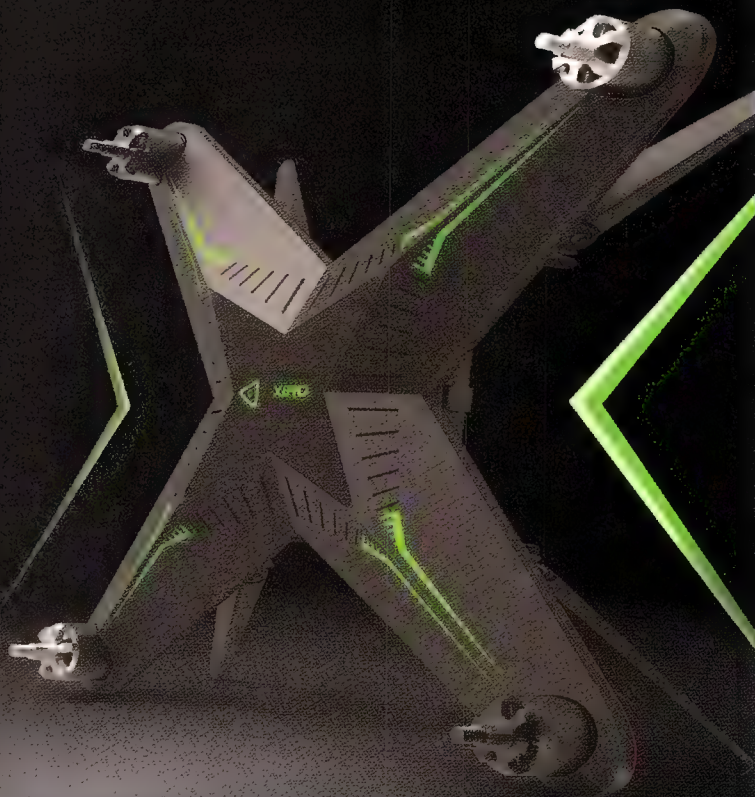
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Innovative rhombus cutting design, gives a strong and simplified cool outlook.

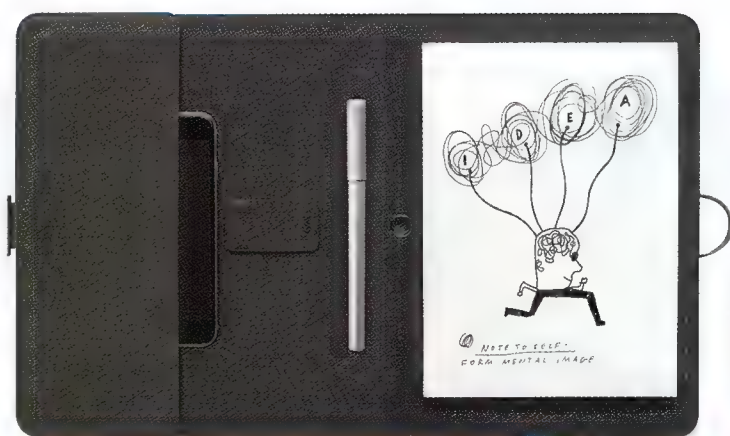
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DIGITAL NOTEBOOK

\$249 | BUYWACOM.COM.AU

Wacom Bamboo Spark

Reminding me my penmanship could do with some work.

Shorthand note-taking and penmanship are lost arts to me. I'm far more efficient and legible with a tablet or laptop. Getting the written word into the computer has also been another hurdle. The Spark looks to make it a little easier.

It works kind of like magic. And by magic, we mean there's an electro-magnetic resonance board nestled in the folio underneath the drawing pad, which tracks the movement of the pen. The information is stored in the folio and, at the touch of a button, transferred to Wacom's Bamboo Paper app via Bluetooth. You can then push your digitised notes out to Evernote and Dropbox. The pen itself is nice and weighty and has good girth, but there's a looseness to the tip and the accompanying noise with each stroke can get annoying really quickly.

There are three slight variations of the Spark to choose from. We looked at the folio with a gadget

pocket. It's big enough to squeeze in an iPad Mini and maybe a few loose documents. There's also a version with a dedicated tablet enclosure and, lastly, one with snap-fit to lock an iPad Mini in place.

Replacement paper refill packs (30 pages each) and ink cartridges are of course available, each costing \$15 for a pack of three. You're likely to chew through paper way quicker than ink.

This is a decent solution for people who take loads of notes that need digitising, but feels a bit clunky for anything artsy. As neat as the technology is, if you're an artist looking to digitise/vectorise your work, grab a sketch pad and Adobe Illustrator Draw instead.

■ Troy Coleman

Verdict

A handy way to get handwritten notes off the paper and into the cloud. Not ideal for artists, though.



DIGITAL NOTEBOOK

\$339 | NOTEMAKER.COM.AU

Moleskin Smart Writing Set

A trendy notebook for effortless digitising of hand-written notes.

The Moleskin Smart Writing Set uses a Neo Smartpen which houses a tiny infrared camera that tracks movement on the page and transfers that data to the M+ Notes app on your phone or tablet.

There's also a mic embedded in the shaft so you can record audio, which then syncs with your notes for playback later. There's enough onboard memory to store 1,000 pages before needing a data dump, but we loved watching notes sync in real-time – it's seamless.

There are other offerings out there that do essentially the same thing, but often the pen is clunky compared to the triangularly lithe Neo. The app also lets you control line-weights and colours.

Once you're done taking notes, you can edit them via the app then share them via email (as an image, PDF, text or SVG) or just spread them around your favourite cloud services; Evernote, Dropbox, Slack, Telegram... the list goes on.

Replacement notebooks are readily available online for a little over \$40 which gets you 176 hardbound leaves. It is worth noting that the notebook's size is 130mm x 210mm, or slightly narrower than A5. While the Smart Writing Set is considerably more expensive than the Wacom Bamboo Spark, the improved functionality, editability and document management easily sets it above the Wacom. It also feels easier and more natural to use, and its small form factor makes it easy to stash or lug around.

For artists, we found line reproduction much cleaner and more reliable than the Wacom – especially when it came to finer feathering, shadowing and detail.

■ Troy Coleman

Verdict

A slick, feature-rich smart pen and paper writing set with enough sharing options for any situation.





GAMING MOUSE
AU PRICE TBC (US\$70) | WWW.LOGITECH.COM

Logitech G Pro Gaming Mouse

Prodigious provider produces prowess.

The G Pro is part of the current trend for stripped-back products, with fewer features but better build quality. Why it still needs 16.8 million colours of LED lighting, though, is beyond us. You only get six buttons on this model, but they're well positioned, and all programmable using Logitech's generally excellent software, which will need an update to work with the new mouse – so beware if you're upgrading from an older Logitech model.

The casing is black plastic in a classic rounded Logitech shape, unbroken apart from splits around the buttons, and the gaps for the dreaded lighting. It's unadorned with grippy panels or thumb-rests, leading to a spartan look, offset by a single shiny patch forward of the wheel. The rolling disc itself is pleasingly broad, deeply ridged, and taking a positive effort to spin from one notch to the next. There's nothing special about it, it's

just a plastic circle without a rubber tire or soft-touch coating, but it is well designed and fairly satisfying to use.

Feel is everything for a peripheral that spends so much time in your hand. It's engineered to be extremely accurate, with a PMW3366 optical sensor, the absence of any smoothing or pixel rounding, and some clever metal springs under the main buttons; the nicely braided cord is a decent length; and it feels good in the hand.

This optical sensor is also in Logitech's cheaper G Daedalus mouse, so you will need to decide whether the G Daedalus's slightly awkward shape is enough to send you to the G Pro.

■ Ian Evenden

Verdict

Built for accuracy, solid body, well-placed switches.



GAMING HEADSET
\$220 | WWW.STEELSERIES.COM

SteelSeries Siberia 350

Do we see acceptable headset LEDs?

SteelSeries' design ethos has shifted from the rugged yet classy aesthetic of the H series and Sensei headphones, to the more outrageous and conceptual design of the Rival and Siberia. These USB 7.1 surround-sound RGB cans are encroaching on true audiophile territory at this price point, but can they compete with the likes of Audio-Technica's M40s and M50Xs, or even Kingston's HyperX Clouds?

Well, they have a frequency response ranging from 10Hz to 28,000Hz, and a built-in USB soundcard, all powered by 50mm neodymium dynamic drivers. Impressive.

Out of the box and on the noggin, these cans are incredibly comfortable. The padding lining the top of the auto-adjusting head cushion is supple and soft. That said, it is a little worrying that there are only two little strips of wire holding the band to the headphones. And this is the only time when

RGB LEDs are acceptable in a pair of headphones. You're still not going to see them, but since the Siberia 350 is wired, you're not going to waste battery life on flashy lights that only your partner will glimpse.

Sound quality is a mixed bag. At this price point, the treble and the upper mids are solid. What lets the 350s down a tad is the lower mids, merging on to the higher end of the bass. It just feels a touch too empty, especially in classical scores.

The Siberia 350s are a unique and interesting take on a gaming headset at this price point, but the disappointing mids detracts from the entire aural experience.

■ Zak Storey

Verdict

Lightweight, comfortable, innovative design, non-impacting LEDs, OK soundscape.





Turtle Beach Elite Pro

A well-built triumph for design quality.

This 'tournament' headset is Turtle Beach's attempt to weld some esports cool to a brand known for solid peripherals.

It uses a straightforward 3.5mm plug to connect to your PC, instead of a fancy digital USB connection, using a four-pole type of connector to integrate its microphone signal. Check that the headphone socket you plug it into supports this if you want to use the removable mic. Anyone in need of more options can get the optional Tactical Audio Controller, which acts as an external USB soundcard.

After two minutes of trying to work out how the cable fits, it snaps home solidly. Plugging in the omnidirectional mic on a bendable stick was similarly straightforward.

When on, the headset is supremely comfortable. The ear cushions are gel-filled and cool against your skin, and while they cut out a lot of background noise, there's no noise-canceling

per se. The first time you put it on, the headband adjusts to your head, with two sliders above the orange pivot points, and height adjustment below. The cord isn't very long, but there's a useful volume wheel and mic-muting button halfway along its length.

Sound quality is great. There's no Dolby cleverness on offer – these are stereo – and without the use of the Tactical Audio Controller, they really are just 'dumb' headphones. While that's not necessarily a bad thing, it does make you wonder what you're paying for.

The answer is thoughtful design and build quality. So if having the most comfortable headset matters, this is a fine choice.

■ Ian Evenden

Verdict

Extremely comfortable; decent sound; fully adjustable. Expensive accessories.



SteelSeries Apex M500

Mechanical keyboards for all.

The M500 is a budget model – a solid slab of matte black plastic, with enough metal in its base to give it a decent weight and purchase on your desktop. Each key sits atop the dependable Cherry MX Red switch. There's no option to change the switches out, but they're comfortable to use, and with a rating of 50 million clicks, they should last a while.

There's some clever cable management going on underneath the keyboard, with three positions for the captive two-metre USB lead to exit from the back. This is such a simple idea, it's remarkable that it doesn't appear on more of the top-end keyboards. While under there, you'll find two feet to raise the keyboard's angle, and some shaped rubber pads that retain their grip.

Thanks to the lack of bells and whistles on offer, one of the first things that strikes you as you look down at the M500 is the typeface used on the keys. It's a large

friendly sans serif, and understands that a W is not an upside-down M. The punctuation, secondary functions and numbers could be bigger, particularly the media keys, but with the blue backlighting, it's still clear and easy to read.

SteelSeries's Engine software enables you to program macros (F keys) and other customisation options, including profile switching across compatible mice and headsets, as soon as you launch a game. There's full anti-ghosting and 104-key rollover.

Concentrating on the basics is what makes a keyboard great, and creating one that feels good under the fingers is the key to a good keyboard relationship. ■ Ian Evenden

Verdict

Stripped-back gaming keyboard that gets all the basics right. Other switch types would be nice, though.





LAPBOARD

\$359 | WWW.ROCCAT.ORG

Roccat Sova MK

Bridging the desk to couch-style PC gaming.

The matte black monster you see above is another of the burgeoning new category of 'lapboards' – lounge-room PC gaming peripherals designed to sit on your lap so you can game in comfort from your couch. And compared to the petite Razer Turret (APC 431, page 40), you'll really know the Sova is there. In the words of Douglas Adams, it's "big, really big" and, at 2.35kg, we reckon it's also been sneaking down to the kitchen in the middle of the night and snacking. But that extra weight does mean it sits steadily on your lap and that's arguably exactly what you need when gaming from the couch.

Sova combines a generous mousepad and wrist rest with a compact-sized keyboard – the model we tested had TTC-made Brown mechanical switches, but there's also a membrane version – but you'll have to BYO mouse. Roccat has emphasised that the Sova is

quite customisable, with both wrist rest and mousepad able to be swapped out for different materials and designs. Which is good, because the hard surface of the default mousepad is quite rough and noisy when a mouse quickly moves across it. It didn't affect performance, but the noise did cause this reviewer's eye to twitch quite a bit during use, mainly due to the loss of immersion it caused.

The keyboard features multimedia keys and per-key customisable blue backlighting, but no macros. Anti-ghosting and N-key rollover is great, with only the odd occasion where a letter gets lost when typing at speed (which, we imagine, won't be this keyboard's main occupation, so it's hardly more than a niggle). There are two USB 2.0 ports on the board itself, nestled down the back next to the detachable power cable – so you can plug your mouse into the keyboard itself (and use the nifty cable channel

to hide the excess cabling) and also connect a USB headset, or even charge your phone or tablet. However, there's no audio jack here, which was a bit of a missed opportunity in our mind. The Sova's main USB cable is amply long at 4m (and has a Y split at the PC end) but that length introduces the inevitable risk of tripping.

So it's huge and offers a reasonable array of features – but how does it feel when in use? Pretty good. That generously-sized wrist rest means it's more ergonomic than a lot of desktop keyboards and the cushioning underneath keeps the board comfortably on your lap for long gaming sessions without complaint. Setting the board up is also a piece of cake – get it out of the box, plug it in, plug in your mouse and go.

One small annoyance was the fact that, unlike the Razer Turret (which had a nifty magnetised mouse), if you tilt the keyboard a little, the mouse slides off the end. So if you're getting up or

shifting yourself on the couch, keep a hand on your little guy.

Bridging the gap between desktop and couch is an ambitious task and the Sova has done a pretty good job. But the sheer size of this thing and the \$359 price tag (without including a mouse) might be enough to give you pause – especially with the Razer Turret going for \$220. Plus, you need to consider storing this monster when it's not in use. Still, the Sova absolutely beats using a regular gaming keyboard balanced on your lap, and for that, we'd say it was mission accomplished.

■ Carmel Sealey

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

A convincing and comfortable way to bring PC gaming to the couch, but not for the budget gamer.





SMARTPHONE AND VR HEADSET

\$399 INCLUDING VR HEADSET | WWW.ALCATEL-MOBILE.COM

Alcatel Idol 4

Android VR goes into another gear.

Straight out of the Idol 4's box, you're faced with another one, which contains both the VR headset and Idol 4 that powers it. We don't often talk about packaging, but Alcatel's method shows that the manufacturer has placed its emphasis on the VR part of the parcel – you'll have to take the VR headset apart to get to the phone.

It's simple enough to do, though, and the VR headset feels like one of the better Android VR headsets we've tested. Since the goggles are custom-made for the Idol 4, there is no eyepiece tracking dial, and the capacitive touch buttons located on the bottom are stylishly integrated. From afar, it shares a lot of its design with Samsung's Gear VR (minus that unit's control pad mounted on the side), and the included strap that goes around and over your head makes the goggles easy to wear.

They're also comfortable with soft but simple foam

padding, and they didn't leak in any light during our test – important to be fully immersed in whatever you're playing or watching. Your first few times using it will be interrupted, however, by each app asking for permission to access storage for media, but once you're in, the screen is clear and engaging. Samsung's Gear VR is still the go-to mobile VR experience, but for a more affordable all-in-one, the Idol 4 and VR headset bundle is impressive.

As for the 5.2-inch phone itself, it's lurking around the likes of the Motorolas and Oppos – a mid-priced, mid-spec phone with features and gimmicks that should entice people wanting some fun with their handset.

Turn the phone on and you'll be immediately prompted to update the firmware to 6.0.1, a good sign that the unit will receive more updates in the future. Looking at the specs again, and you'll see that it shares a lot with the

Motorola Moto G4 Plus, which we rated highly in our sister mag *TechLife* (see issue 54, page 46), but our raft of benchmarking software shows it falling short in a few areas. Geekbench scored this at 685/1,969, putting the Idol 4 in Oppo R7 territory in terms of raw power.

Its battery life could likewise perhaps be a bit better: 6 hours 24 minutes in the tough PCMark 8 for Android test isn't terrible, but most phones manage at least 7 hours.

Of course, benchmarks aren't a perfect measure of real-world use, and in the hand, the Idol 4 is pleasing once you're used to its quirky layout. You'd never lust after the Idol 4 with its odd buttons and speakers that jut out away from the edge of the screen, and it'll trip up anyone who holds it in their right hand. Where your thumb naturally rests is Alcatel's 'Boom' button, which activates different functions according to the context. Screen off, it'll

wake the unit. At the home screen, it'll animate your background to give you an indication of the weather. Play music and it'll ramp up the bass and treble. The button can be customised to do one thing, which you'll likely do to save your sanity.

Considering the price and design, the Idol 4 is a real contender. The only other manufacturer to bundle a phone with a VR unit (or at the least design goggles to use with a phone) is Samsung, and the S7 is leagues ahead – and at about three times the price.

All in all, the Alcatel Idol 4 is a fine mid-range phone.

■ Paul Taylor

Verdict

Features	★★★★★
Performance	★★★★
Value	★★★★

A generally pleasing and affordable phone + VR headset combo that does all the basics well, though not brilliantly.



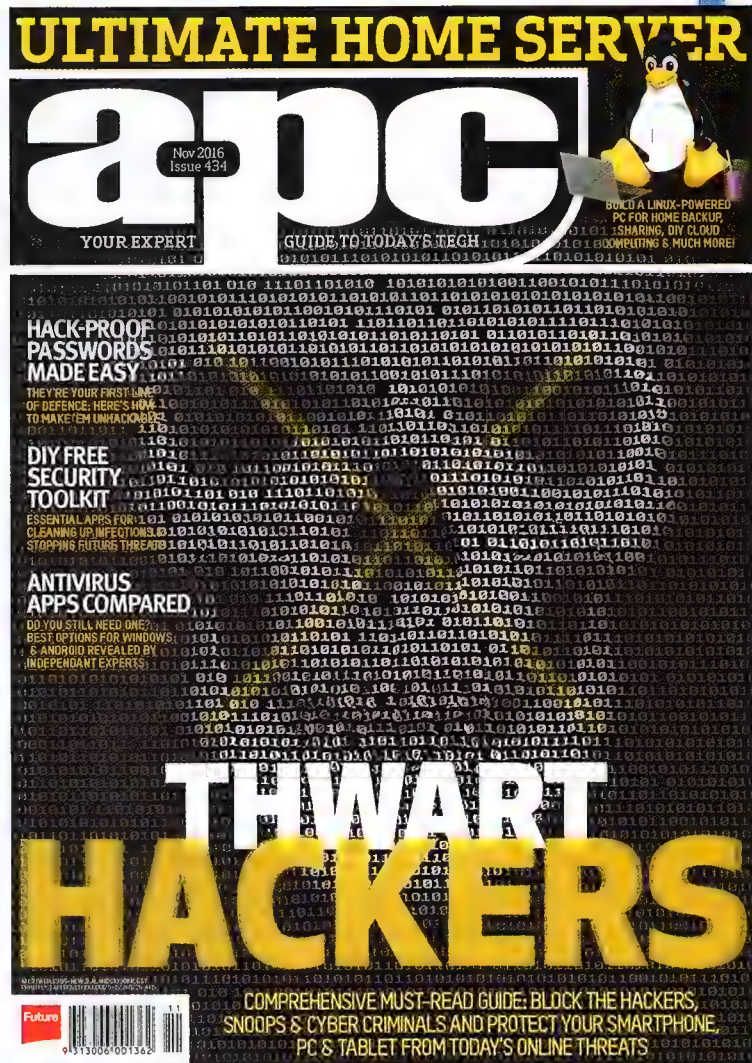
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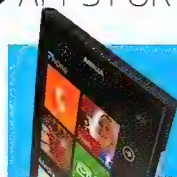


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software

» APPS FOR ALL THE PLATFORMS



Windows Store » WIN PHONE

Monument Browser

A monumental shift to your phone browser.

FREE | [TINYURL.COM/APC434-MON](http://tinyurl.com/APC434-MON)



We spend a lot of time traversing the web on our phones, but there are often circumstances where we've found ourselves wanting to flick back and forth between sites quickly.

While you can do this in browsers like W10 Mobile's inbuilt Edge by toggling a tabs list and swapping between the windows you need, a new offering called Monuments Browser is geared towards better web multitasking — specifically, viewing and interact with multiple browser windows at once. View pages using either picture-in-picture mode (with one small screen floating inside a bigger one) or in a 50/50 split screen. Other than copying between pages, the dual browser setup also lets you download multiple files from different sites at once in the background. The app is still in beta and currently lacks a history log, so you'll have to bookmark the pages you'll want to navigate to again later. Other than, that this speedy and light browser that offers a decent alternative to anything else out there on Windows phones at the moment. **Joel Burgess**



VLC

VLC makes media playback as easy as doh-ray-me.

FREE | [WWW.VIDEOLAN.ORG/VLC](http://www.videolan.org/VLC)



Though VLC has been available as a tablet-friendly Windows Store app for some time, a

Universal Windows Platform (UWP) version, with true phone support, only recently emerged from closed beta. As the most renowned open-source media player on the planet, this broadly-compatible media playback software should really need no introduction. Other than the absurdly long list of compatible video formats, this app also has the capacity to transcode files on the fly and search for subtitles from within the app. The new offering is slightly more streamlined than what's available on some of the more-established platforms and won't offer Blu-ray playback options unless you're using the desktop version, but the core video and music playback components are all here and you can expect the usual automatic metadata scraping features too. There's also full access to networked storage allowing you to stream movies to your phone directly from your server (or NAS box or shared folder). All up, we're impressed with the final version of this VLC UWP app — it's a must-have addition to if you're on a Windows phone.

Joel Burgess

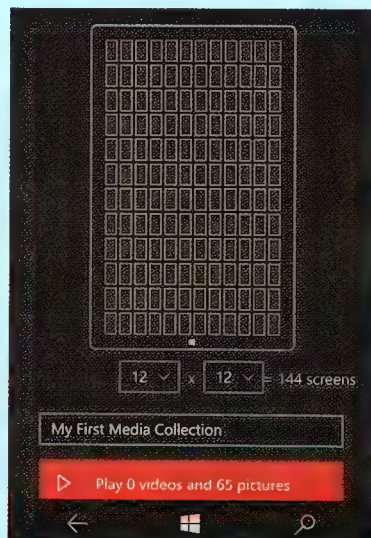


Spinster

This app has many suitors.

FREE | [TINYURL.COM/APC434-SPINS](http://tinyurl.com/APC434-SPINS)

If you've ever needed to have two videos playing simultaneously on a computing device, it turns out it's often a rather complicated process, and that goes doubly when you're attempting to do it on your smartphone. Yes, it's not the most common task, but if you're someone who does want to use your Windows phone to cycle through videos and pictures, you'll find there aren't all that many options at your disposal. Spinster is one of the better options — it's a UWP app that will allow you to watch multiple videos or dynamic photo slides simultaneously. The app gives you the option of selecting up to 12 rows and columns each to create a maximum 144 screens on your device — a number that was well beyond the hardware capabilities of our Lumia 950 test phone. We couldn't actually get more than two videos to play simultaneously, but in theory, if you had a device that was capable of processing more video, you'd likely get a better result. This simple-to-use application is a great solution to a very specific problem. **Joel Burgess**





Mac » APPS

Parallels Desktop 12

Run Windows apps directly from your Mac's desktop.

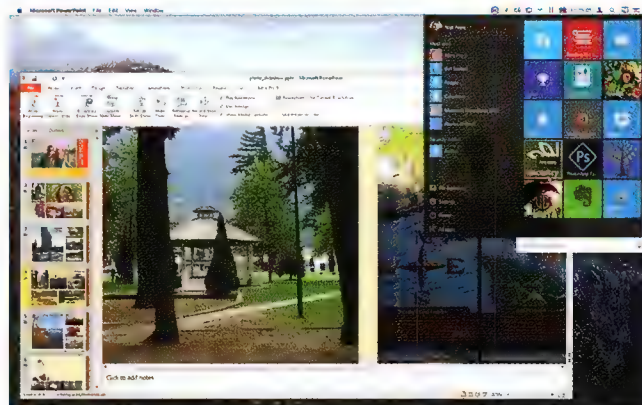
FROM \$99.95 | PARALLELS.COM/AU | OS X 10.10 OR HIGHER



Parallels Desktop has been our go-to solution for running Windows apps on the Mac for some time now. Our favourite feature is Coherence Mode, which allows you to blend your Windows apps right into the OS X desktop itself, making them appear like native apps. Parallels Desktop 12 attempts to continue its gradual evolution with a smattering of tweaks and improvements, but the absence of noteworthy new features makes it a hard sell for existing users.

The pre-launch hype has been around Parallels Toolbox, a collection of 20 mini-tools that aims to plug various gaps in OS X, with examples including a one-click 'Do Not Sleep' button and a tool for downloading video. This is clever and potentially useful, but not particularly earth-shattering, and does little to enhance Parallels Desktop itself.

As always, what changes Parallels does introduce are welcome ones, but they're evolutionary rather than revolutionary. With Coherence Mode, version 12 adds a distraction-free presentation mode that disables notifications, hides desktop icons and forces your Mac to stay awake, plus you can now assign default behaviours to individual Windows apps, such as always opening them in full-screen mode. Website passwords from Edge and Internet Explorer can be integrated into OS X's keychain, and Office



options appear in OS X's contextual menus too. Parallels 12 also comes with a year's 500GB cloud backup with Acronis True Image, which is then integrated into Parallels to allow you to back up incremental changes to your virtual machines. Great, but going forward, will you have to pay, or switch to Parallels' subscription-based Pro edition? Existing power users will find the \$64.95 per year subscription tempting given that it includes Parallels Access and a subscription covering future Parallels Toolbox updates in addition to Pro-only features like the Network Conditioner (which simulates 3G and other slow networks), but it's overkill for most.

Every year we're told Parallels gets faster and better. With version 12, Parallels is forced to find niche areas to tweak: suspend times (up to 60% faster) and shared folder access (up to 25%), for example. It also has support for the Windows 10 Xbox app and the game *Overwatch*, but Direct X 11 support is still missing. There's value in Parallels for first-time users looking to easily integrate Windows apps into the Mac desktop. But there's little to tempt existing users, and we can't help but feel that Parallels needs a radical rethink if it's to avoid stagnating going forward. **Nick Peers**

BusyCal 3

FROM US\$49.99 | BUSYMAC.COM | OS X 10.11 OR HIGHER

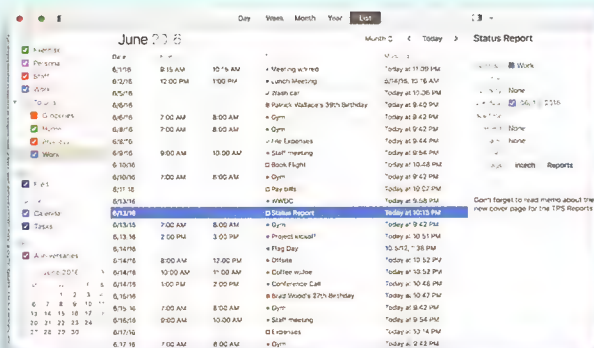


BusyCal 3 looks and feels a lot like Apple's Calendar, but it offers a number of improvements. There's a redesigned menu bar utility with a mini month calendar and a scrolling event list, plus a detailed info panel in the lower-right corner of the app's main window (which can also be displayed in a floating one).

Reminders are integrated into BusyCal as to-dos. These show up alongside regular events on the main calendar and as a list in the right-hand panel, though we couldn't get iCloud reminders to show up until we added a new to-do in BusyCal. In a good move, you can assign specific times to each of your to-dos.

We love BusyCal's smooth scrolling too, which enables trackpad users to quickly zip between days, weeks or months with a single swipe.

The biggest new feature in BusyCal 3 has been borrowed from Calendar: travel time. It works the same way too: when you enter a location-based event, BusyCal will work out how

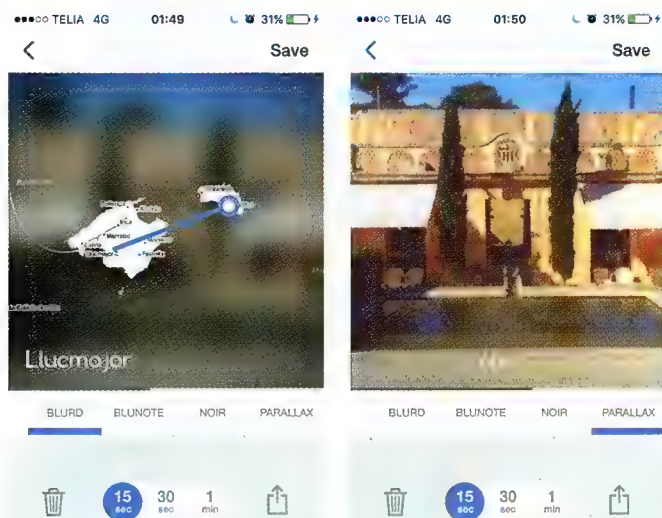


long it takes to drive or walk there, and alerts you when it's time to leave based on traffic conditions.

There's finally a single iOS version for iPhone and iPad, with identical features to the Mac one. The month view feels cramped on iPhone in portrait view, but it does a fine job of replicating the Mac experience on mobile. **JR Bookwalter**



App Store » iOS APPS



Storyo

Like Instagram, but louder.

FREE | STORYOAPP.COM



Storyo takes your photos from a certain point in time (say, a holiday in Hawaii, a friend's graduation or a wedding) and turns them into a cute pre-prepared slideshow — a bit like iOS 10's

Memories feature. This builds on the idea by offering several filters, which all have nice touches: borders, music, transitions and fonts that add to an overall feeling of sunniness. You can alter most of this to your taste, too, giving each slideshow a title and changing the music to one of Storyo's presets or your own music, if you prefer. However, the music automatically plays every time you create a story, which makes the app quite offputting, because you're not sure if it's about to ambush you with chirpy ukelele tunes.

The slideshows are sweet, though there aren't quite enough customisation options. Interesting touches such as animated maps make it worth adding your geotagged pics, but generally, no matter what photos you use, the video always feels centred around exciting trips abroad. There are also automatic stories that Storyo will push on you: Hey, I made a new story about everything you've done this week, it'll say. Then you'll look at it, and it's a bunch of receipt photos so you can do your expenses.

Overall, Storyo is the kind of app you'll love if you want to spice up your Facebook feed with something a bit different, but don't go expecting full video-editing tools, or having any of your videos look much different from one another.

All in all, cute but slightly limited, Storyo is a great accompaniment to Instagram for anyone looking to show off their vacation pics.

Kate Gray

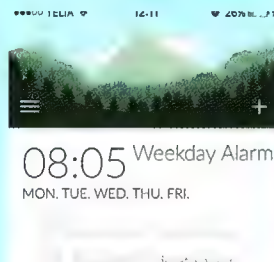
Kiwake Alarm Clock

\$2.99 | KIWAKE.COM



What are you supposed to do when you're reviewing an app that you fervently hate with the fire of a thousand suns, but which does the job it's supposed to do perfectly? That's our conundrum with Kiwake, an app that promises to get you up every morning, even if you've struggled to do it with any alarm before.

The core concept is simple, giving you three steps to wake up your body and brain, and to generally motivate you to keep going. The 'body' step makes you take a photo of something far from your bed — great if you always sleep in the same room and you have one object you always see, but if you travel, it's a bit of a hassle. The 'brain' step makes you complete a couple of short, simple games that test your memory and reflexes. Get them right three times in a row and you'll get to the 'motivation' step, which is a bunch of stuff you input when you set up the alarm that might make you want to wake up early: save money, have more time, look better...



The reason this app is so easy to hate is that there is no way to snooze it. You can't skip a step, because it beeps angrily. You can't cheat. You can't even close the app. BEEP. BEEP. BEEP. You'll never snooze again, but you might develop a lifelong grudge against the (probably) lovely people who made this app.

Designed by people who genuinely want to help you wake up, Kiwake is smart, simple and well-crafted.

Kate Gray

Vizable

FREE | VIZABLE.TABLEAU.COM



Vizable attempts to make data comprehension accessible for everyone by turning the data into easy-to-understand graphs so that users can immediately grasp the differences in points of data. Vizable reads CSV and XLS spreadsheet files, so if you've got other apps that export data as a spreadsheet file, you can easily import it. Vizable is a joy to navigate and includes pinch and pan gestures that allow users to view only the data they want, and save, share or print it.

There is a downside, though: if you're tracking your own points of data, you'll either have to be comfortable creating your own spreadsheets in programs such as Numbers or Excel, or you'll have to find another app — there's nothing that allows you to actually create spreadsheets in Vizable itself. Still, even if you have to use Vizable as a companion app to other apps, we think it's invaluable. Track your business profit, log your activity straight from your FitBit, or just create attractive sharable graphs for school projects. It's a truly a wonderful and versatile app. Amber Neely



Google Play » ANDROID

Parallel Space

Run multiple accounts of the same app simultaneously.

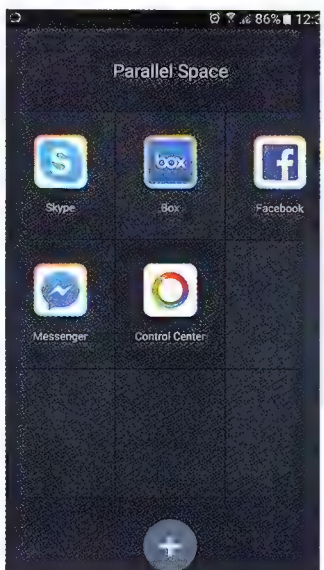
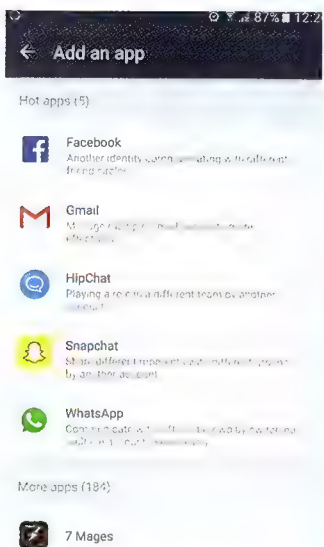
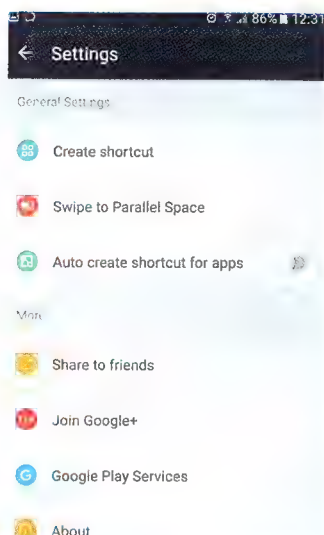
FREE | PARALLEL-APP.COM



Most people are probably content with just having

one account on any given app or service. But whether you're a secret agent or just like keeping different groups and aspects of your life completely separate, there are times when you might want multiple accounts.

Sadly, most apps don't make this easy, usually forcing you to log out with one before logging in with another, which is both frustrating and time-consuming. But Parallel Space bypasses that, letting you run apps independently from within it and keep a second account logged in. That can be useful if you want different Skype or cloud storage accounts for work and friends, for example. Actually using Parallel Space is slick and simple. The main screen shows all the apps you have secondary accounts for and you just tap to launch that account and use the app as normal. Creating a second account for an app is just as simple, launching it from within Parallel Space and logging in with a different account.



Curiosity

FREE | CURIOSITY.COM/APP



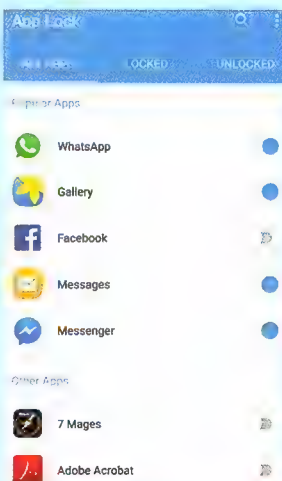
Self-improvement apps are as multitudinous as roadside waste at this point, and while most seem to focus on physical fitness and time management, there's also a huge category for making you smarter. While that appears to be the goal with Curiosity, its name implies that it'll reward those who just enjoy learning and knowing stuff. The app throws up a handful of interesting facts every day. Each is expandable and each links to related content — usually YouTube videos — if you want to know more. Today, we learned that the "Earth has returned to the same spot in the galaxy as it was during the age of the dinosaurs", which is reasonably interesting, but your mileage will vary. Pop science tends to be the dominant area of interest, and while the presentation is pleasant enough, it's hard to imagine most people opting to choose to open this app instead of visiting some 'interesting' website. Maybe with widget functionality, Curiosity would shine. Shaun Prescott

AppLock

FREE WITH IAP | WWW.DOMOBILE.COM



Sometimes, locking your phone isn't enough. Say you want to lend it to a friend or colleague but don't want to risk them digging up those ill-advised photos you took in Ibiza or that *Harry Potter* fanfic you've got planned out in your notes app. With App Lock, there's no danger of anyone getting into anything you don't want them to, as you can use it to lock individual apps with a PIN, pattern or fingerprint. The app itself is mostly just a long list of your other apps, with toggles for whether you want to lock them or not, so there's not much to it, but it does what it sets out to without any bloat. The lockscreens it presents you with look good too, with colours to match the apps they're locking. But if you're using a fingerprint scanner, you won't waste too much time looking at them anyway, as you'll be swiftly in.





SMPlayer

An accommodating media player that makes playback SMPlE.

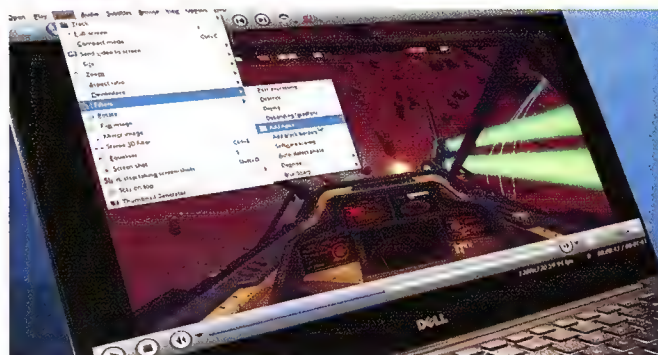
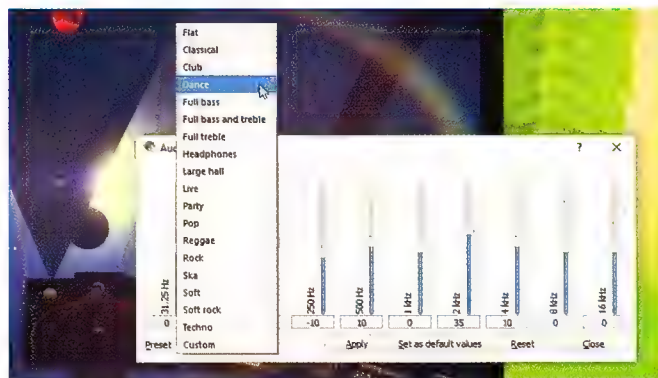
FREE | TINYURL.COM/APC434-SMP



SMPlayer is primarily a video player, but it can also be used to listen to music and other audio tracks. It supports a huge range of file formats out of the box, and includes a handy feature that means it remembers where you are in a video even when you close it down.

In addition to files stored on your hard drive, the program can be used to play YouTube videos – but that's just the very beginning. There's support for subtitles, a graphic equaliser, a screenshot tool, adjustable playback speed, customisable playlists, subtitles, the option of using skins and much more.

One of the key problems with media players – and video in general – is the sheer number of codecs required to ensure broad compatibility. SMPlayer has a huge number of codecs built-in, which means you're very unlikely to find a file that it won't play (its developers make the bold claim that it "can play virtually all video and audio formats"). **Mark Wilson**



Corel Painter 2017

The veteran natural-media app is back for more.

FREE | COREL.COM

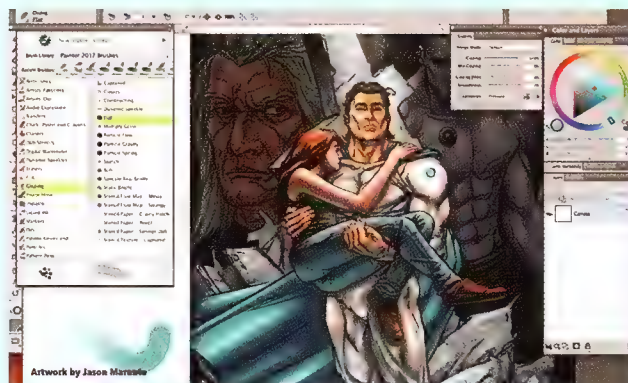


The last few years have seen Painter keep its place at the top of the natural-media painting app pile, but it's been hard to see where it could go forward. In the 2017 edition, the developer has innovated with new tools, as well as improving existing ones. The app itself hasn't changed much in feel or operation, which is good.

The toolset is pretty comprehensive, as well as very realistic. It's very easy to get to grips with, especially if used with a tablet. Many tools respond to stylus angle and rotation, as well as position.

Painter 2017 adds a number of new tools, the most notable being the texture and glazing tools. The texture tools enable you to intelligently work textures into your work based on underlying imagery. There are a number of presets, but it's simple to add your own. You could easily take a photo of a concrete wall, define that in Painter, then use that to add texture to your artwork in a variety of ways. The most obvious use for this would be for fast-working concept artists who need to define a look, or even for 3D artists painting texture maps for use in CG.

The glazing tools are a set of transparent brushes that build up as a real-world glaze would, enhancing depth and colour. Painter comes with a number of preset brushes and, as with all Painter brushes, there is a huge amount of control and customisability available. This continues with the interface as a whole, with palettes that can be moved, collapsed, stacked or hidden, and layouts that can be saved.



The interactive gradient tool has been tweaked and now gives better performance, alongside some new options, such as edit nodes – a helper for applying gradients to existing art. There's also a new Gradient Express tool, which is aimed at relieving the problems of staring at a fresh document and not knowing how to start. The gradients can have brush styles applied for rapidly working out a colour theme or background, to get you thinking creatively. This, in conjunction with the texture tool, is a great way to start any piece.

It's hard to criticise what is an excellent app, but if anything, it can suffer from being too comprehensive; it's easy to forget some of the options, as there are just so many. The interface isn't as modern as many other apps, but it does its job well.

All in all, this is a surprisingly innovative update to an excellent art app, with interesting new tools and enhancements. **Rob Redman**



Linux » OPEN-SOURCE SOFTWARE

Pitivi

Non-linear video editor.

FREE | WWW.PITIVI.ORG

Linux is known as a well-established platform in video editing with lots of top-quality applications for non-linear video processing. Pitivi is one of the most prominent applications, which you should definitely try even if you're not planning on directing movies.

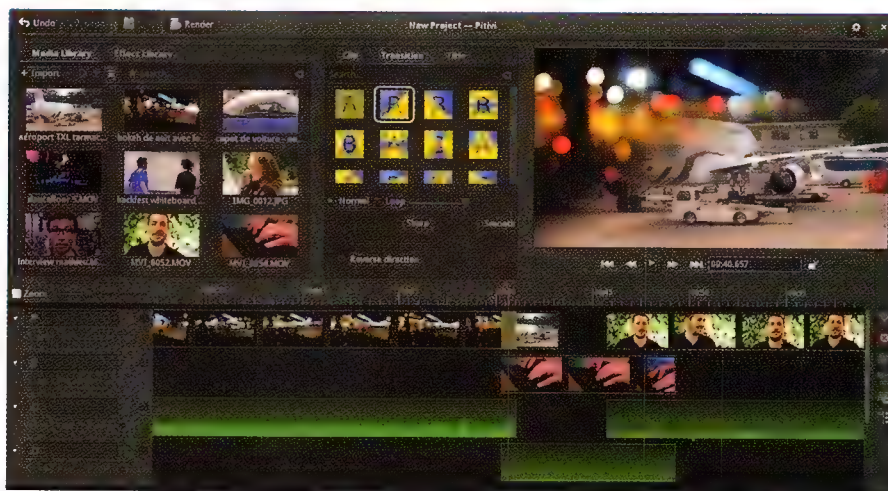
Pitivi has been moving towards the 1.0 release, but it has just reached version 0.97. The list of new features includes a rewritten video rendering dialog and more accurate GStreamer codecs support, which means that if a codec or a container is listed as available it's guaranteed to work.

In other respects, Pitivi is a classic editor that balances simplicity and a readiness for professional use. The interface has four areas: the top-left is for storing your imported clips and surfing through the Effects library. Next, there's a small panel where you can control what transitions and effects are applied to what clip. The top-right area is a small preview window with playback controls below it. As you might expect, the largest part of the screen below the three other blocks is dedicated to the timeline. This is where your new movie is being created from clips. You can drag clips on the timeline, group and ungroup them, align them and add a personal touch with lots of eye-catching visual effects.

Pitivi has a very nice set of fancy effects for simulating retro colour films, various distortions, colour overlay effects and so on. In order to export your work into something you can share with your friends or publish online, you'll need to make sure you've installed the extra GStreamer codecs as Pitivi heavily depends on the whole Gstreamer framework.

Pitivi is part of almost all Gnu/Linux distros, so you don't need to surf the internet or add third-party repositories in order to install it.

Alexander Tolstoy



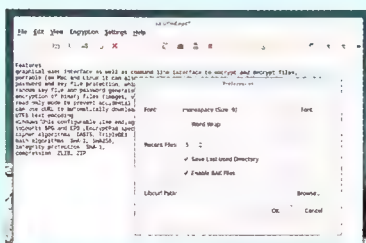
EncryptPad

FREE | EVPO.NET/ENCRYPTPAD

EncryptPad is a free and open-source text editor with built-in data protection. It protects files with passwords, security key files, or both, and can also be used to encrypt binary files, such as images or videos.

EncryptPad has plenty of security-related features — random key file and password generator, support for downloading keys from remote locations, optional read-only mode and more. The editor uses its own EPD file format, where your data is protected with cipher algorithms, file integrity is maintained via hash sums and the whole thing is compressed with ZIP. Commonly there are two passwords for each file: one is the direct password and another is for unlocking the key. It means EncryptPad is a good solution when you need to store sensitive information on unprotected media, such as a notebook, memory stick or unencrypted cloud storage. When running, EncryptPad stores unencrypted text in memory and for this reason, it's recommended to shut down EncryptPad when not editing or reviewing text documents.

Alexander Tolstoy



Tor Browser

FREE | WWW.TORPROJECT.ORG

Tor is focused on privacy, security and anonymous internet access. It applies a collection of hacks, custom settings, tweaks and workarounds to Firefox and all network traffic is redirected through the Tor Network to deliver greater anonymity. Tor Browser helps people bypass certain government regulations and generally leaves less of a digital trail on the internet.

Specific tools used by Tor Browser are the HTTPS Everywhere Firefox extension, NoScript for resisting JavaScript-based threats, and the Fteproxy utility to prevent traffic blocking and inspection.

The new browser relies on the updated Tor framework (v0.2.8.6), which starts faster and is more flexible for when you need to set custom ports for Tor traffic. Tor Browser looks and feels like Firefox, because it's based on Mozilla's updates, sync service and other 'desktop' features. It can also be run as a portable version as well, allowing you to write to a USB thumb drive and take your secure web browser with you.

Alexander Tolstoy



Blazing fast USB storage

External SSDs are edging closer to being a viable option as speedy, compact portable hard drives, but are they there yet? Joel Burgess investigates.

We'd have to say that, until Samsung released its T1 drives last year, we really didn't consider solid-state or flash storage to be particularly appealing alternatives to traditional portable external drives. But fast forward a year and there's enough emerging competition for the segment to be genuinely interesting – well, for those of us who are prepared to spend the money to get the fastest and most compact portable drives available.

From our testing, there are definitive speed benefits of SSDs and fast flash USB drives against traditional HDDs and even 'fast' external dual disk drives in a RAID configuration. However, what is most groundbreaking is that this new realm of speedy portable drive has dropped to a price point that is significantly more affordable than it was a year or two ago.

Our favourite drive benchmarking utility, CrystalDiskMark, also recently has updated its software to utilise Q32T1 tests that will more accurately peg the transfer speeds of SSDs and USB flash drives.

General Performance

SEQUENTIAL READ	(DISK SPEED MB/S)
SAMSUNG PORTABLE SSD T3 1TB	402
SEQUENTIAL WRITE	(DISK SPEED MB/S)
SAMSUNG PORTABLE SSD T3 1TB	394.9

0 100 200 300 400 500



FROM \$199 (250GB); 1TB, \$579
WWW.SAMSUNG.COM/AU

Samsung Portable SSD T3 1TB

A totally new generation of portable SSDs.

Samsung's Vertical-NAND breakthrough was one of the biggest advancements SSD technology has seen in recent years and it's fair to say that the company's investment in this research has trickled down into its consumer SSD products. Encased in a metal and powdery-plastic coating, the Portable SSD T3 is compact but weighty. Combine its noteworthy design with a distinct advantage in performance across the board and you get an idea of just how impressive this drive is. The T3 netted sequential read speeds of 402MB/s and write speeds of 395MB/s and scored similarly well in Q32T1 sequential read and write results, landing 433.5MB/s and 412.1MB/s, respectively. The fact that Samsung then prices these drives competitively despite the outstanding performance (the 1TB T3 is \$300 less than HyperX's Predator, page 42) means that these drives are truly in a league of their own.

Verdict

Visually interesting and impressive performance at a competitive price.



General Performance

SEQUENTIAL READ	(DISK SPEED MB/S)
SANDISK EXTREME 500 120GB	335.4
SEQUENTIAL WRITE	(DISK SPEED MB/S)
SANDISK EXTREME 500 120GB	283.6

0 100 200 300 400 500



\$109 | WWW.SANDISK.COM/AU

SanDisk Extreme 500 120GB

A solid state diamond in the rough.

If we were to award one of these drives for its design novelty, this would have to take out the title. This flat, round-edged SSD has a USB 3.0 micro-B interface that's, surprisingly, the thickest part of the entire unit. One of the key benefits of solid state drives is that they're more resilient to knocks and drops than traditional disk-based drives. SanDisk has played to this SSD characteristic by pitching an ultra-portable rugged styled drive that caters to photographers that are out and about (there's even a waterproof version, the Extreme 510). This drive performs in line with what should be expected from real-world tests of fast flash drives and portable SSDs, recording sequential read speeds of 335MB/s and write speeds of 284MB/s. Though the value fluctuates amongst the differing capacities of the Extreme 500, the 120GB model was one of the best-priced drives we found, being readily available for around \$100 online.

Verdict

Pocket-sized diamond-shaped drive with great performance and price.



General Performance

SEQUENTIAL READ	(DISK SPEED MB/S)
LEXAR PORTABLE SSD 512GB	323.4
SEQUENTIAL WRITE	(DISK SPEED MB/S)
LEXAR PORTABLE SSD 512GB	246

0 100 200 300 400 500

General Performance

SEQUENTIAL READ	(DISK SPEED MB/S)
HYPERX SAVAGE 128GB	311.5
SEQUENTIAL WRITE	(DISK SPEED MB/S)
HYPERX SAVAGE 128GB	210.7

0 100 200 300 400 500



apc
RECOMMENDS

\$256 | WWW.LEXAR.COM

Lexar Portable SSD 512GB

A fast but surprisingly frumpy portable SSD.

We were excited to get the Lexar portable SSD in, thinking that (like Samsung) this premium drive would have an external build quality that matched the premium price tag. So you can imagine our disappointment when we found out that, rather than polished metal, this portable SSD is cased in a rather flimsy textured plastic body. Add to this an unusual USB 3.0 Type-B connection on the drive (which is really only otherwise found in enterprise printers and other high-end devices) and a front-facing LED array that displays the drive's currently utilised capacity and you have the external composition of this premium drive. Looks aside, this is still quite a speedy portable drive, and with sequential read speeds of 323MB/s and writes of 246MB/s, you won't be let down by its performance. It's still sufficiently compact and \$40 less expensive than Samsung's 500GB T3, so you have some compelling reasons to choose Lexar's half-terabyte portable SSD.

Verdict

Doesn't share the premium design as its main competitor but, performance-wise, it's reliable and speedy.



\$149 | WWW.HYPERXGAMING.COM

HyperX Savage 128GB

A slick and speedy drive that could do with a discount.

The gaming-styled, metallic-red X-shaped frame that wraps around this drive both conceals its size whilst unapologetically flashing its speed stripes. The soft, black powdery plastic and the heavy metal alloy combine to give this flash drive a uniquely weighty and premium feel. Similar to the Predator (over the page), the Savage is a flash-based drive that keeps up with SSDs in most of the general usage speed tests, but is a rung behind the Predator across the board. This thumb drive has no additional cable, but being roughly the same size as most other USB keys means it isn't large enough to really warrant one. Interestingly, the HyperX Savage uses the USB 3.1 interface despite using a male Type-A connection. It pushed through sequential reads at a respectable 312MB/s and could write at 211MB/s, which isn't particularly fast. It's a little pricey when you consider you can net some of the larger-capacity 256GB drives here for a similar price.

Verdict

Not overly fast and a touch pricey, but with a distinctly unique design and premium feel.



What to look for

What to look for when purchasing an external SSD or flash drive.

Interface

All the drives tested here are either USB 3.0 or 3.1, but there is no reason Thunderbolt adaptors couldn't work equally as well for devices aimed at Mac users. Be careful not to buy anything with USB 2.0, as it won't be able to transfer faster than 60MB/s (practical transfers of around 35MB/s).

Connection

This is related to the interface but the two main connections to be aware of are USB Type-A (the most common USB connection) and USB Type-C. You'll need to check it'll be compatible with the ports in the devices you wish to use it with.

SSD vs Flash

USB

The difference here is largely semantic and historical. SSDs were originally made from a type of DRAM memory (similar to what your computer uses as memory), but these days any affordable SSD will be made from NAND flash technology.

Size

SSDs and flash USB drives still have distinct form factors as a matter of habit and so it's worth working out if you want a compact portable hard drive shape or if you would prefer to plug in an oversized USB flash drive.



the » external ssds

General Performance

SEQUENTIAL READ	(DISK SPEED MB/S)
LEXAR JUMPDRIIVE P20	310.6
SEQUENTIAL WRITE	(DISK SPEED MB/S)
LEXAR JUMPDRIIVE P20	243.9



\$119 | WWW.LEXAR.COM

Lexar JumpDrive P20

A subdued speedy flash drive with a professional touch.

Other than the extra bulk that you'd expect from flash drives of this capacity, the Jumpdrive P20 from Lexar is the most regular-looking high-speed USB key we've come across. A silver metal body and black plastic top facade cover the retractable USB 3.0 Type-A plug, so you can add it to your keyring without fear of bending the connection. The Jumpdrive P20 comes bundled with the EncryptStick Lite 256bit AES encryption software to add an extra layer of protection. Though it might look conservative, when it comes to speed, this drive is anything but. Sequential benchmarks of the P20 weren't quite the fastest (at 311MB/s read and 244MB/s write), but they're not too shabby compared to other USB flash devices. Scores improved slightly while using the 32-queues and 1-thread transfer protocols that can better-test flash-based memory, hitting 238MB/s read and 200MB/s write scores. It is a little expensive, though.

Verdict

Not the best value for money, but with decent speeds and added software protection.



General Performance

SEQUENTIAL READ	(DISK SPEED MB/S)
BLUEEYE THUNDERDISK PRO 256GB	358.7
SEQUENTIAL WRITE	(DISK SPEED MB/S)
BLUEEYE THUNDERDISK PRO 256GB	140.1



\$248 | WWW.ARC.COM.AU

BlueEye Thunderdisk Pro 256GB

This older drive is still fast, but the pricing model seems a little dated...

The BlueEye was one of the first 400MB/s transfer drives available back in 2015, but it still holds up against the competition today. The model we tested uses the perfectly adequate USB 3.0 interface, though you can now get new iterations that use USB 3.1 with Type-C to Type-C. The BlueEye Thunderbolt Pro managed to attain sequential read and write speeds of 359MB/s and 140MB/s, which stacks up well against the other SSDs and fast flash drives in terms of read speeds, but is frankly underwhelming in the write department. The drive did better than all except Samsung's T3 in terms of small file read and writes, though, netting 107MB/s and 74MB/s in 4K filesize with new Q32T1 read and write tests. As it is a little older, you'd think you'd get some sort of a discount, but even if you're prepared to shop around, the dated BlueEye still goes for around \$50 more than SanDisk's Extreme 500 240GB models... and it'll cost close to \$250 if you don't hunt.

Verdict

An old model that can still pull its weight but can't quite stand up against the competition, especially at that price.



General Performance

SEQUENTIAL READ	(DISK SPEED MB/S)
HYPERX PREDATOR	362.4
SEQUENTIAL WRITE	(DISK SPEED MB/S)
HYPERX PREDATOR	249.8



\$904 | WWW.HYPERXGAMING.COM

HyperX Predator

This flash drive will keep up with an SSD, but at what cost?

This was one of the largest capacity drives we tested in this roundup, but the underlying flash-based technology means that it's physically constructed like a thumb drive, with its own USB Type-A plug built-in. It does come with a SuperSpeed blue USB-A female-to-male cable that will save you if you have to plug it in next to anything else that might be connected to your computer. The Predator also comes packaged with a chrome keyring to attach the device to your keychain, which is a nice touch that was unique to this model... but then, when you notice the drive retails for an eye watering \$900, the keychain feels like the least HyperX could have thrown in. The transfer speeds are good for flash, but line up identically with most of the SSD transfer speeds at 362MB/s and 250MB/s for sequential reading and writing, respectively. Considering Samsung's faster Portable SSD T3 costs \$300 less, the Predator is difficult to recommend.

Verdict

Larger than your average USB thumbstick but with little more than novelty to recommend it here.



44
**THWART HACKERS &
LOCK DOWN YOUR
DIGITAL IDENTITY**

Make your PC more
resilient to hackers
and malware.

52
**SECURE PASSWORDS
MADE EASY**

We put the heavyweight
password managers
head-to-head and give
you a quickstart guide to
getting up and running
with one.

54
**WINDOWS SECURITY
SUITES COMPARED**

Need a security suite for
your PC? We scrutinise
the top eight.

58
**THE BEST ANDROID
SECURITY SUITES**

The most widely used
operating system in
the world is far from
invulnerable. We reveal
the best security apps for
your Android devices.

62
**DIY FREE SECURITY
TOOLKIT**

Make your own security
suite with these free tools.

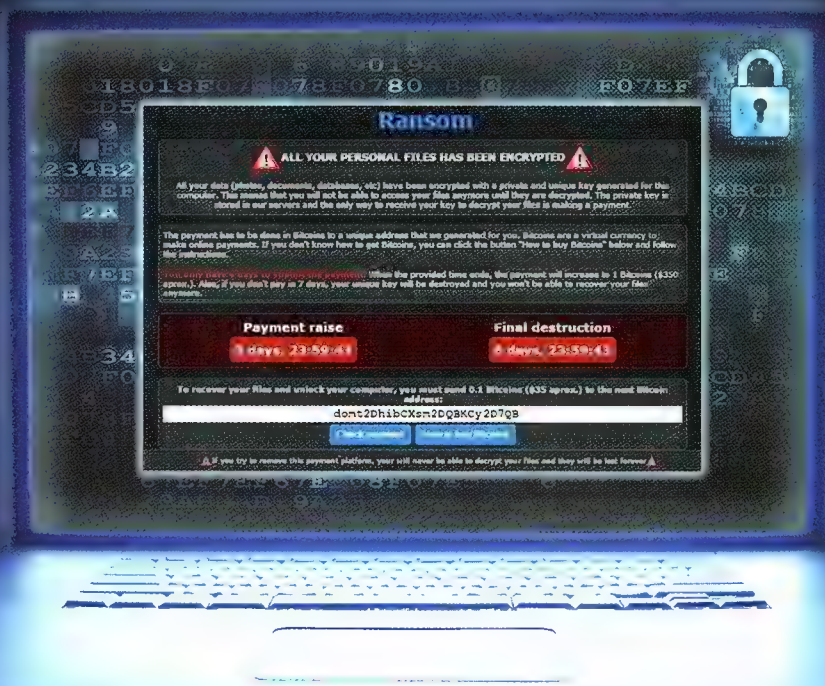
64
**CREATE AN
EMERGENCY
USB STICK**

Put together all the
essential apps you'll need
to deal with potential
PC disasters.

THWART

HACKERS

COMPREHENSIVE MUST-READ GUIDE: BLOCK THE HACKERS, SNOOPS & CYBER CRIMINALS
AND PROTECT YOUR SMARTPHONE, PC & TABLET FROM TODAY'S ONLINE THREATS



Thwart hackers & lock down your digital identity

Make your PC more resilient to hackers and malware, with some help from Nick Peers.

Once upon a time, the act of protecting your PC against viruses was simply to install an antivirus program, and watch what floppy disks and CD-ROMs you introduced to it. Then we all got internet access, and you needed to make sure you didn't download anything dodgy, while introducing a firewall to dissuade drive-by hackers. And for a while, that seemed to be sufficient.

How times have changed – and with ever-increasing rapidity, too. Nowadays, the threats keep coming, finding ever more inventive ways of getting through defenses, using trickery as much as anything else. But however hard the hackers fight, the security folk fight back, helping develop new forms of protection,

removal and repair to thwart the cybercriminals.

As it was in the beginning, prevention is always better than cure. Far better to tighten the security on your PC than have to go through the trauma of removing unwanted software, or battling a demand for thousands of dollars from a ransomware attack. But where do you begin? What software do you need? And how can you change your behaviour to minimise your exposure in the first place? In this feature, we'll help you on all these counts.

We'll reveal the core protection you need, plus run through the various ways in which your online activities put you at risk, and how to protect yourself accordingly. You'll discover how to encrypt your email, properly

screen downloads for viruses and potentially unwanted programs, keep malvertising at arm's length, and ensure none of your online accounts are easily – if at all – hacked. We'll help secure your home network, too, so people can't piggyback on to your Wi-Fi, or gain access to your home devices through your router.

And what happens if you do get infected? Don't worry – we'll run through some ways in which you can wrest control of your PC back from the malware, plus point you in the direction of some useful tools that can help you recover from a ransomware attack, even to the point of potentially decrypting your precious data.

Without further ado, let's get this (anti-malware) party started!

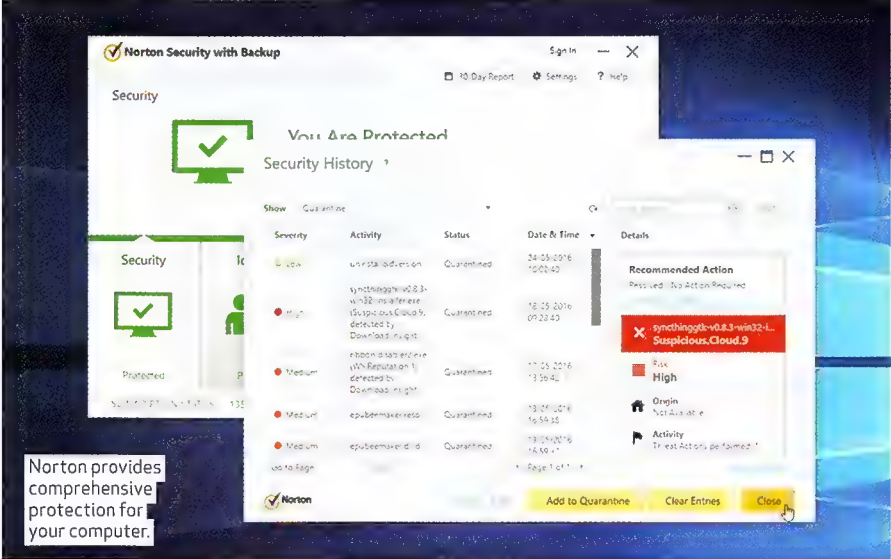
It goes without saying that you need anti-malware software. Windows 10 comes with Windows Defender for basic protection, but it's outclassed by most other anti-malware tools. The best free antivirus tools include BitDefender AV Free (www.bitdefender.com/solutions/free.html) and Panda Free AntiVirus (www.pandasecurity.com). However, if you're looking for more comprehensive security (including a third-party firewall), ESET Smart Security (www.eset.com/us) is renowned, along with Kaspersky (www.kaspersky.com), while we've personally relied on Norton Security (www.norton.com) for nine years.

In the past, you could only run one antivirus app on your PC at once. These days, there exist anti-malware apps designed to work in tandem with other security software. The most visible is Malwarebytes Anti-Malware (www.malwarebytes.org).

The free version provides scan-and-remove tools, but for continuous real-time protection, and the ability to block malicious websites — vital when it comes to keeping out malvertising and potentially unwanted programs (PUPs). Speaking of PUPs, it's worth installing a tiny, free program called Unchecky (www.unchecky.com) to keep unwanted add-ons off your PC.

TIGHTEN UP YOUR ROUTER

One of the most effective ways of making your PC as hacker-proof as



possible is to review the way you use your PC. Let's begin by securing your PC's connection to your network and the internet. First, your network — if you connect through Wi-Fi, make sure you have WPA2 encryption enabled in your router's settings, and choose a strong, randomly generated password that can't easily be remembered, if at all (write it down, and store it somewhere secure).

Worried about drive-by hackings, where people get within range of your wireless network, then attempt to gain access to it? Reduce your network's

visibility by disabling SSID Broadcast, then changing the SSID of your network to a name that's not easy to guess. If you're truly paranoid, enable wireless MAC filtering (use the 'ipconfig /all' command in a Command Prompt window to find out your PC's MAC address, in order to whitelist it first), change your network's IP address from the usual 192.168.0.x to 192.168.y.x (where 'y' is between 1 and 255), and disable DHCP.

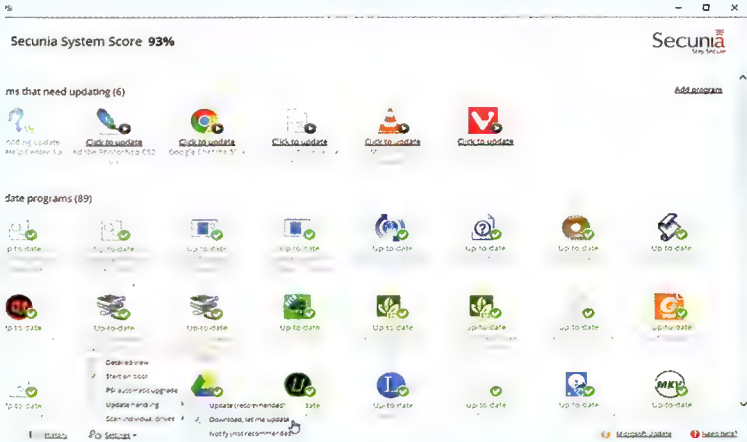
With these settings in place, a hacker would need four things to gain access: first, your network SSID and its

The importance of being updated

Hackers are always looking for weak spots to exploit, and often find them in the underlying code that makes up Windows and all the programs (and associated extras, such as browser add-ons) on your PC. When vulnerabilities are found, hackers use 'zero-day exploits' to take advantage of them.

Most good anti-malware software has built-in behavioural protection against these exploits — it works by monitoring your PC's processes for suspicious behaviour that could point toward a zero-day attack, and takes steps to block it. It's not foolproof, though — some false positives can be found, and other exploits can go unnoticed.

As always, the best form of protection is prevention, and that means keeping your system up to date. It's one of the reasons why Windows 10 now forces its updates down your throat, and most good software automatically checks for new versions when it's first launched — never skip this, particularly if its changelog refers to security updates. Most browser add-ons should update automatically, too, but Flash is one you should keep an eye on — it's more vulnerable than most zero-day exploits, and given the rise in support for native HTML5 video streaming, you might want to experiment with disabling it altogether. (In Firefox, go to 'about > addons', select 'Plugins', and set Shockwave Flash to 'Ask to Activate' — that way, you're



alerted when a site needs it, enabling you to make an informed decision on whether to run it.)

If you're struggling to keep your programs updated, use a free tool called Personal Software Inspector (bit.ly/softinspector), which carries a database of thousands of supported apps, and tells you exactly which ones need updating at any given time — in many cases, it can even do the updating for you

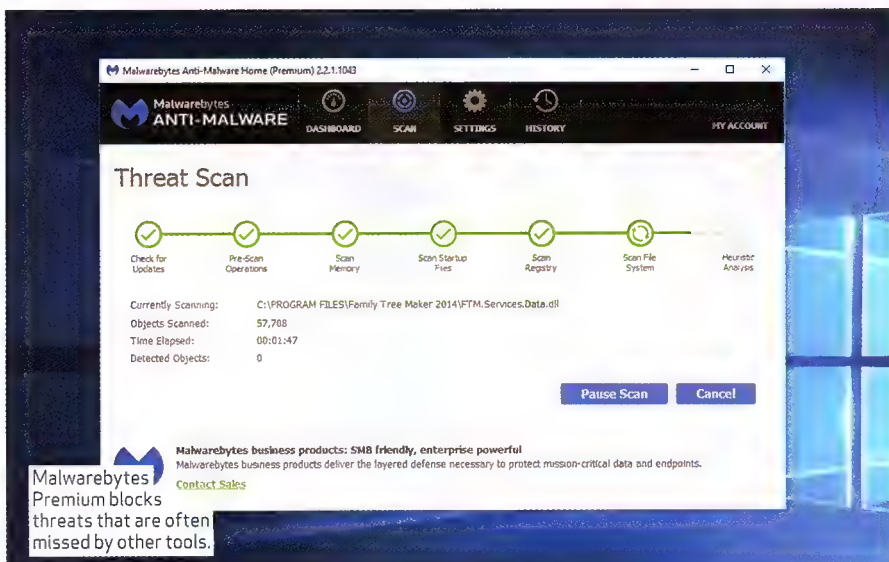
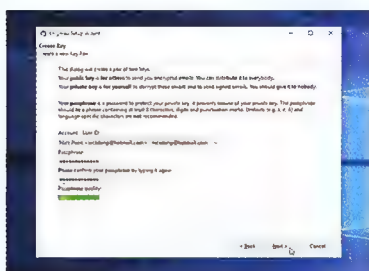
Encrypt Your Email

Make sure your email provider supports secure methods for sending and receiving email — for webmail providers, that means ensuring you're always logging on through 'https://' to prevent your password being sniffed out by hackers. In the case of major providers such as Google, this should now be the default, but also look for other ways in which to protect your account — see the 'Protect Online Accounts' box over the page.

If you use a traditional email account, check with your provider that it supports SSL, and verify you're using those settings in your mail program to send and receive messages. This ensures your password and the content of your emails are encrypted when sent to or received from the server.

As things stand, however, the content of your email isn't encrypted during transit, and is easily readable. If your mail provider supports TLS, it's possible to encrypt emails you send to and receive from other email providers that also support TLS. Taking Gmail as an example, the feature is enabled by default, but look for an open red padlock when composing emails — this indicates that the receiver doesn't support TLS, so the conversation won't be encrypted. Otherwise, check with your email provider to see if TLS is supported, and what settings you need to apply in your client — plus check to see if it's able to make it clear which conversations are encrypted, and which aren't.

TLS isn't a silver bullet, so if you want to go further (with co-operation from other individuals), look at implementing PGP mail encryption. This encrypts the mail before it's sent, and then the recipient uses PGP at their end to decrypt the mail once it arrives. Wizards make it relatively easy to set up, but Google your email client (or webmail provider) and 'pgp' to find out more.



password. They'd also need to know a MAC address to spoof, and know what IP address to assign to their device (as well as the IP address of your router), just to get on your network. In reality, this will make network setup long-winded, so you may want to strike a balance (perhaps leave DHCP enabled, for example).

Next, tighten your router's other settings. Verify its firewall is switched on, and review any ports you're forwarding — these are channels from the Internet to your networked devices, so make a note of what they are, remove any not in use, and disable those you don't need permanent access to. Also, review your UPnP settings — these ports are dynamically allocated to applications running on your network. Disable any suspicious ones, and search for the originating apps to remove them.

It's also important to protect access to the router's settings. Change the default password to a stronger one (change the username if allowed, too), and look for a Remote Management or Remote Access option. This latter setting enables you (and anyone else) to access your router from outside your home network, using your public IP address (or dynamic hostname, if you have one). Disable this setting.

LOCK DOWN YOUR NET CONNECTION

Virtual private networks (VPNs) offer a number of security and privacy features — not only can you anonymise yourself and your location when connected through one, but they also encrypt all your internet traffic, which makes them an essential add-on for your laptop or tablet when surfing a public, unencrypted Wi-Fi hotspot.

There are many free services, such as CyberGhost (www.cyberghostvpn.com), but these come with limits —

CyberGhost's only limitation is the speed of your connection, which is noticeably slower. Paid-for plans, starting from around US\$6/month, lift this limit, and there's no wait before you connect.

If you'd like to run your entire home network through a VPN, you need to use a second router that supports the DD-WRT firmware — check out www.techradar.com/1300740 for a complete guide.

BEHAVIOURAL CHANGES

Unfortunately, gone are the days when the only way malware got on to your system was through opening files or programs; these days, many threats are triggered by your own behaviour, through misdirection.

So how can you protect yourself from, err, yourself? Let's start with email, where most of the initial phishing originated. First, treat all email with suspicion. If it's peddling an offer too good to refuse, or making dire threats while exhorting you to click a link to verify your account or respond to some kind of dispute or offer, just take a deep breath. Re-read the message, spot the spelling mistakes, or the fact the address you've been emailed isn't the one you've linked to your bank account. Who's the sender? In the vast majority of cases, these basic checks will reveal that the email is a fraud.

Get into the habit of never clicking links in emails. Instead, open your browser, and visit the site specified by typing its address. But that's not all you need to do against emails. Some contain malicious code hidden in the mail's HTML, so configure your email client to read mail in plain text by default. Also, consider installing a mail-checking tool, such as POP Peeper (www.esumsoft.com) or Mailwasher (www.mailwasher.net), which can screen

automatically use secure connections, but others don't — even though they support them. Force all compliant sites to encrypt your connection by installing the HTTPS Everywhere add-on for Chrome, Firefox, and Opera (www.eff.org/HTTPS-everywhere).

MALICIOUS ADD-ONS

Browser add-ons such as WOT and HTTPS Everywhere help tighten browser security, but it isn't surprising that not all add-ons are what they seem, with many able to track your movements and steal personal data. Malicious add-ons have been injected into the Chrome Web Store in the past, while some cybercriminals buy up legitimate add-ons, only to introduce nasties through updates, which are automatically installed. Even those add-ons that appear to be reputable can sometimes be poorly coded in such a way as to make them vulnerable to exploits.

First, exercise extreme caution before installing any add-on — do all the usual checks, such as checking who the publisher is, and reading reviews (and paying particular attention to any that allege the add-on is spyware or spam). Google the name and words such as 'malware' or 'exploit', to see if they're linked in any way. Check the permissions (particularly during an update, where an add-on may ask for additional permissions it didn't previously need), and ask yourself why it wants them. Also regularly check your browser extensions, removing any you no longer need or don't recognise.

Consider using bookmarklets, too, instead of add-ons — bookmarklets contain tiny bits of code that do simple things, such as tweeting the current page, but they can't automatically update, and only run when you click the bookmarklet. Again, be sure to obtain these from reputable sources, and be as sceptical as you would with an add-on.

DOWNLOAD PROTECTION

Downloads are a common source of malware, so make sure the installer is scanned by your anti-malware tools before you launch it — right-click the file to find the relevant option, such as 'Scan with Malwarebytes Anti-Malware', if it's not done automatically (Norton pops up a message in the Taskbar Notification area to tell you it's scanning the file, for example).

An increasing number of developers provide checksums for the software you've just downloaded. These checksums, also known as signatures or hashes, are typically used to verify a download isn't corrupt, but can also be used to calculate its authenticity, too. You need a third-party tool to generate the 'hash' of the file you've downloaded, then you compare this with the checksum given online — it's not definitive proof, by any means, but it's a useful extra step.

There's a number of different hashes used: MD5 and SHA are the most common, and the MD5 & SHA Checksum Utility (<https://raylin.wordpress.com>) makes it easy to verify either type. Just select your downloaded file, then paste in the hash from the webpage, and click 'Verify' — the program quickly confirms that the two match.

There's one major development to look out for when downloading software. An increasing amount is shipped as 'bundleware', which means it includes other program installers, offered to you during installation. Reputable installers make these offers crystal clear, and make it obvious how to opt out of them, but an increasing number don't, making it all too easy to accidentally install unwanted extras, not all of which are desirable.

It's not just individual programs, either — major download sites (we're looking at you, Download.com) have also started bundling extra unwanted software with downloads, and some of this is little more than 'crapware', or even borderline malware. In the case of Download.com, examine the green

'Download now' button carefully for a greyed-out 'Installer Enabled' sign — if it's there, it means the application is installed using Download.com's own installer, which contains bundleware. You'll find that MD5 & SHA Checksum Utility is downloaded through Download.com, but thankfully there's no bundleware included.

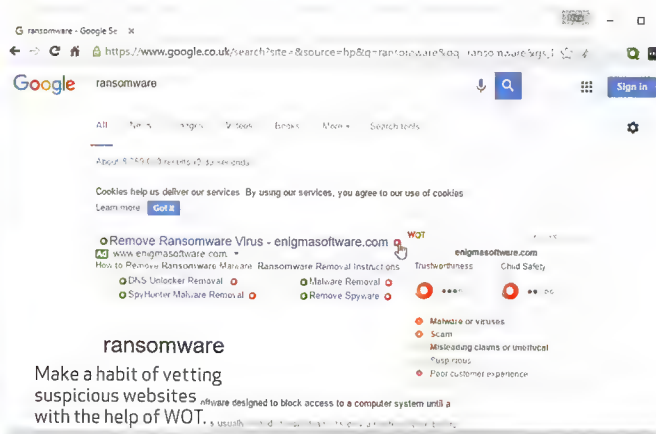
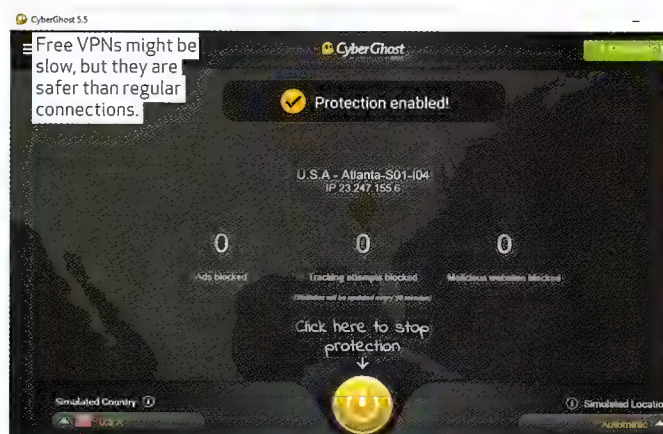
Programs such as Unchecky and the Premium version of Malwarebytes screen most of these out — you still get the original program, but they either change the bundleware's default settings to prevent the extra programs being installed by default, or may block the bundleware portion of the app. Either way, you get a notification that they've worked on your behalf.

Even if you have these programs installed, they're not foolproof (particularly Unchecky). Therefore, you need to take extra care during the installation process — look out for licence agreements referring to other programs, and examine any checkboxes carefully to ensure you're not about to inadvertently install an unwanted extra. Some offers come with 'Accept' and 'Decline' options — choose the latter, and you move on to the next part of the process, or close the installer and source a different program that doesn't take such risks with your security (often, authors have no control over what bundleware is installed with their program).

Fan of torrenting? You need to be doubly cautious — torrents from official sources (such as Linux installer ISOs) are usually safe, but if you're venturing into dodgy territory, looking for the latest TV episodes, be very wary. Check comments and reviews of individual torrents to see if anyone else has spotted anything dodgy, and run the usual scans before opening any files.

SOCIAL NETWORKING

One way in which we inadvertently hand out personal data is through our social networking profiles. Ask yourself if you really want to share



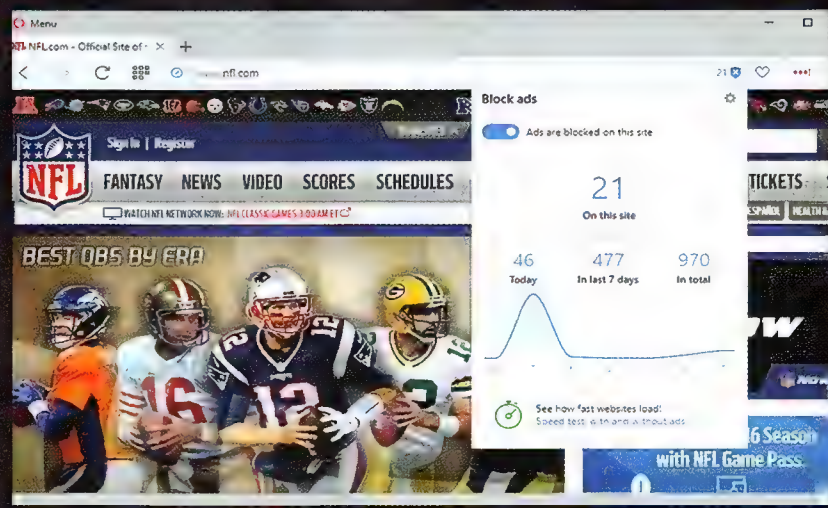
Block malvertising

Many instances of ransomware are delivered through malicious advertising — or ‘malvertising’. This is the process of injecting malicious malware-laden ads into legitimate online advertising networks and webpages — since 2012, billions of ad impressions have been hijacked, including trusted sites. This malware gets through defences, and can silently infect users’ systems — no interaction required.

So how do you protect against these ads? Your anti-malware software should have some protection — both Norton and the Premium version of Malwarebytes have defences against malicious websites built in, and you’ll see a steady stream of alerts as sites are blocked, not just from your browser, but other apps, such as Skype, too.

Make sure you’re running the latest version of your browser and Adobe Flash, as some malvertising targets vulnerabilities, as we discussed in the ‘Importance of Being Updated’ box (page 45). Speaking of which, setting Flash to run only on your say-so is a good idea, as encouraging advertisers to stop using Flash for their ads is one way to improve security going forward.

There’s also an argument for avoiding dangerous websites, where these kinds of ads (as well as other unwanted pop-ups) tend to proliferate — use your WOT or Norton Safe Web browser plugin to steer clear.



Perhaps the most effective way to protect against malvertising is through ad-blockers, which block all ads that aren’t expressly allowed. Norwegian browser Opera (www.opera.com) is the first to provide ad-blocking natively — no plugins required. Alternatively, install the Adblock Plus plugin (<https://adblockplus.org>), which works with all major browsers and is open-source. Be sure to whitelist trusted (and responsible) sites, though, as adverts are the lifeblood of many, enabling them to distribute content for free.

your birthday publicly with everyone on Facebook, or why a particular social networking add-on needs to know so much personal information about you. Take the time to check your profile’s privacy settings on all your networks, to review what data you’ve handed over to the network, and how much of it is public. Avoid making public posts that unintentionally give out information you use as security questions

elsewhere (your mother’s maiden name, for example, or the city of your birth). And, as always, ensure your accounts are protected by strong passwords, with two-factor authentication where possible.

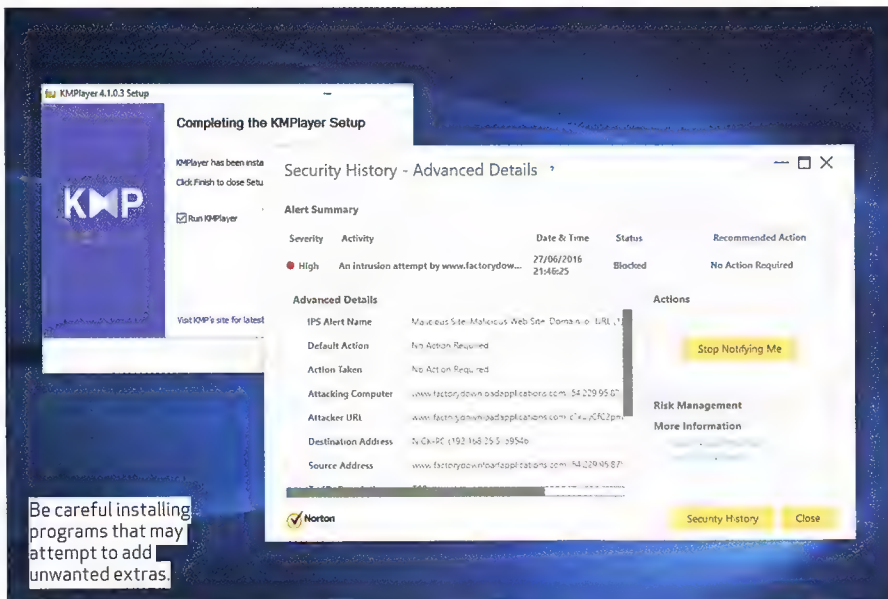
Many web links shared over social media — particularly on Twitter — are often shortened to save on characters, but how do you know the link published is genuine?

Visit checkshorturl.com, where you can input the shortened link to examine the original webpage it points to, plus check the link’s safety ratings on WOT, Norton and various other reputable sites.

RANSOMWARE

One of the biggest threats in recent times comes from ransomware, specially formed malware that locks you out of your PC or your data (typically by encrypting it), before demanding a ransom in return for receiving the code required to unlock it. One clever trick on the thieves’ part is to ramp up the pressure by hiking up the ransom cost the longer you delay. Most anti-malware tools should offer some form of protection, but check with your vendor to see what it can and can’t do. BitDefender has released a ‘vaccine’ that can block some ransomware, by tricking it into thinking the computer is already infected — see the March 28 entry under <https://labs.bitdefender.com/blog/> for details and a download link.

The most effective way to protect against ransomware is to keep your PC backed up — a drive image of an entire drive, or file-based backups of your data (including cloud services, such as OneDrive) ensure you’re protected. In the case of file-based backups,



RL - Unshor

checkshorturl.com/expand.php



Recovering from Ransomware

What happens if you receive a ransomware demand? First, identify its type — there are those that block access to your PC, and others that encrypt data, then demand a ransom to release it. The former usually tries to trick you by claiming to have found unlicensed software or other illegal material on your PC, while the latter is more upfront.

Make a note of the Bitcoin wallet address used for payment demands, plus the filelist of encrypted data — should the private keys used by the criminals ever come to light, it may give your data. Next, verify you have a recent backup that's safe and uncompromised (check on another PC).

Finally, you need to clean your system. Try running scans with your anti-malware tools to see if they can remove the infection. If necessary, reboot into Safe mode — hold Shift as you click the power button, and choose 'Restart', which should bring up the Advanced Boot Options menu. From here, select 'Troubleshoot > Advanced options > Startup Settings', and choose option 5.

If the scans don't help, try a dedicated removal tool — search for 'ransomware', 'removal' and anti-malware vendors, including Trend Micro and BitDefender. If you can identify the exact form of ransomware, you might find a specific removal tool.

These tools tend to focus on ransomware that blocks access to your PC. If your files are encrypted by ransomware, in most cases, you have to rely on your backup to restore them (only after verifying the infection has been removed). Visit <https://noransom.kaspersky.com> first, though, as it has tools that can decrypt files from a wide range of data-scrambling ransomware infections. 

these offer multiple versions of your files, enabling you to roll back to a pre-hijacked version; drive images enable you to wipe the drive and restore Windows, your apps, settings and data from scratch, with all but those changes made since the image was taken. Use a tool such as Macrium Reflect Free (www.macrium.com/reflectfree.aspx), with daily incremental images to keep the file size down.

Try to keep at least one copy off-site — in other words, not directly connected to your computer. Otherwise, it's possible that the ransomware could locate the backups and encrypt those, too.

Future attacks may target your cloud storage, for example.

REPAIRING THE DAMAGE

It's not always possible to keep infections off your system, so what can you do if they get through your defences? If your system is working, try running scans with your existing tools — reboot into 'Safe mode with networking' if necessary, via 'Start > Settings > Update & Security > Recovery > Restart now', to access the Advanced start-up menu.

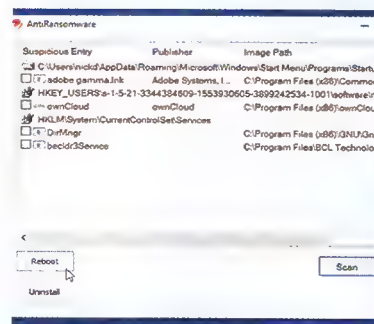
From here, choose 'Troubleshoot > Advanced options > Startup Settings', then restart, and pick option 5. If this fails, you need some additional tools. First, download RKill and ADWCleaner from <https://toolslib.net> (use another PC if necessary, transferring them across on CD or DVD). Run the former to terminate known malicious processes, but don't reboot if prompted. Next, launch Malwarebytes, update it, then select 'Settings > Detection and Protection > Scan for Rootkits', before running a Threat Scan, letting it clear

everything it finds. If you need additional cleaning of adware, browser toolbars and hijackers, and other PUPs, run ADWCleaner, plus Malwarebytes Junkware Removal Tool (www.malwarebytes.com/junkware-removaltool), which may find things missed by Malwarebytes itself. See the box on the right for tips on removing ransomware.

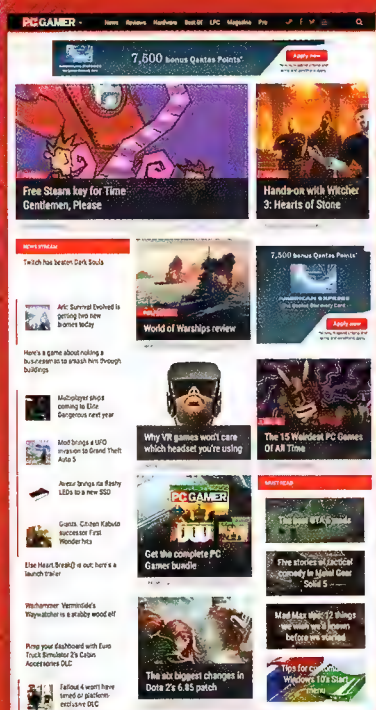
Another tool to consider is the Emsisoft Emergency Kit — this is a portable dual-engine scan and remove tool, which can be downloaded direct to a portable USB drive on another PC (be warned: it's rather large, at 228MB). Run the tool once on the second PC, and update it when prompted, then plug it into your sick PC, and let it attempt to find and remove the nasties.

Once your PC is clean, you may need to perform certain repair tasks. NetAdapter Repair All In One (<https://sourceforge.net/projects/netadapter>) can help with broken Internet connections, for example, while the Windows Repair Tool (www.tweaking.com) can give your system the once-over, as well as restore functionality, such as resetting Registry and file permissions, removing policies set by infections (such as blocking access to Task Manager or Regedit) and repairing Safe mode.

With your PC running smoothly, follow our tips to tighten security, then restore any backups if necessary. With a fair wind, you'll put your security scare behind you, and sail into calmer, safer waters going forward.



SMARTER COOKIES ENABLED



JOIN US ONLINE AT
WWW.PCGAMER.COM

Secure passwords made easy

Joel Burgess puts three password managers head-to-head and explains how to get up and running with one.

Let's be frank. We all know that we need to use secure passwords. But like most safety and security advice, actually following that guidance tends to just feel like additional work in our already jam packed lives... until, of course, you actually get hacked or scammed.

If you've ever been on the wrong end of a hijacked email account or even full-on identity theft, even the most difficult password manager apps will likely seem positively user-friendly by comparison. A password manager is essentially an encrypted vault that allows you to keep a range of different login details and passwords (and even other confidential info), while also making it easy to create and store different highly-secure passwords for each of your accounts and, ultimately, encourage you to develop safer security habits.

There are more than a few password managers you can choose from, but there are really three that have found themselves at the top of the popularity list: 1Password, Dashlane and LastPass. Each of these three are standout performers for different reasons and though password managers might not be the most exciting tech subject to cover, their distinctions do make massive differences to convenience and security so choosing the right one is critical.



SINGLE USER, US\$64.99
ANDROID, IOS, MAC, WINDOWS, BROWSER
WWW.AGILEBITS.COM

1Password

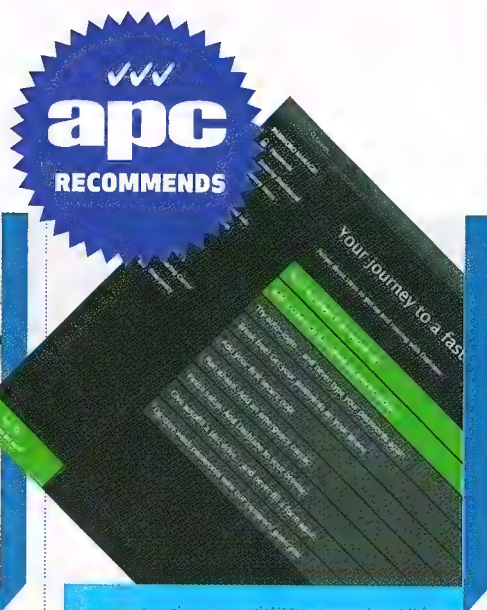
The hardcore Mac password manager for security purists.

1Password stores your logins locally (the only service of the three we've tested here to offer this), making them impervious to hacks on the company. The fact that AgileBits doesn't store your passwords is (depending on your viewpoint) both a major feature and a limitation. You can sync your 'vaults' using third-party services relatively easily if you have a Dropbox, iCloud or NAS, but there have been some criticisms that the metadata of these vault files isn't secure.

Where 1Password is particularly good in a business or team setting, allowing you to sync specific vaults with specific groups and keep your library organised by segmenting vaults. It's also worth pointing out that, although there is a Windows app, the latest version 6 build is still considered to be in beta. 1Password has browser extensions for Safari, Chrome, Firefox and Opera and there's a built-in password generator in all versions, so it does cover all the basics.

Verdict

Good for Mac-wielding security purists, but the lack of built-in cloud syncing will be a dealbreaker for many.



US\$39.99 PER YEAR
ANDROID, IOS, MAC, WINDOWS, BROWSER
WWW.DASHLANE.COM

Dashlane

This password manager is prime real estate.

Dashlane is still one of the more expensive options, requiring a US\$39.99 a year subscription, but if you've been using a password manager for some time, that price point does seem a little more reasonable than if you're just starting out. Dashlane has a standalone application, but also offers the convenience of cloud-based vault management. A standalone application not only looks significantly better, but is also notably easier to use for non-browser based tasks – while you may not need these as often, with Dashlane, it's less frustrating when you do. It also has a unique automatic password changer that can be set to automatically change and update your saved password for specific services without you having to manually log in and do it yourself. After revisiting Dashlane's offering, it does seem better value, but that said, it's still expensive enough that you may want to carefully assess whether you need its extra features.

Verdict

If money were no object, this'd be our favourite password manager.





**BASIC VERSION FREE; PREMIUM SUBSCRIPTION, US\$12 PER YEAR
ANDROID, IOS, MAC, WINDOWS, BROWSER
WWW.LASTPASS.COM**

LastPass Now the second-last password manager?

Although it does offer native apps on desktop and mobile alongside browser extension for most popular options, LastPass is, at heart, a cloud-based service that lets you access and edit your passwords directly via the LastPass site. Its versatility in terms of third-party integration unfortunately doesn't extend to two-factor authentication apps – it's developed its own functional (but far from market-leading) multi-factor authentication app for iOS and Android instead. It has major breach tracking (so it'll warn you if one of the services you use has been hacked), can assess how secure your catalogue of passwords are and has its own strong-password generator.

It is totally cloud-based and the service does store encrypted master passwords itself (potentially a deal breaker for hardcore security purists) but combined with a strong master password that you change occasionally that should largely negate that concern.

Verdict

The best-value offering by a long way, which only misses out on a couple of non-critical features.



Get started with a password manager

It's not as complicated as it sounds – here's how to quickly get up and running.

Password managers are pretty simple to set up and though you could dedicate the time to enter in all your passwords straight off the bat, for most, it's easier to just jump through the hoops when the time comes to log in to different services. This will make the initial setup a reasonably speedy exercise, but you will need to create a master password and it's worth setting up a form fill template and entering in your credit card details – it'll securely save and fill these details wherever you go on the web at the click of a button.

Master password

A master password is the key to your kingdom and, though it might seem like one, single overarching password that unlocks all your others is a security disaster waiting to happen, if it's a well-formed encrypted password manager login, then it is the most secure way to do it. The key to a well-formed password is part maths, part randomness and should include more than 8 capitalised and lowercase letters, numbers and symbols and ideally should be created by chance. The use of various character sets increases the variables exponentially, 8 is simply the mathematical sweet spot that has 7.2 Quadrillion possible combinations and takes an acceptable period of time (for today's supercomputers around 82 days)

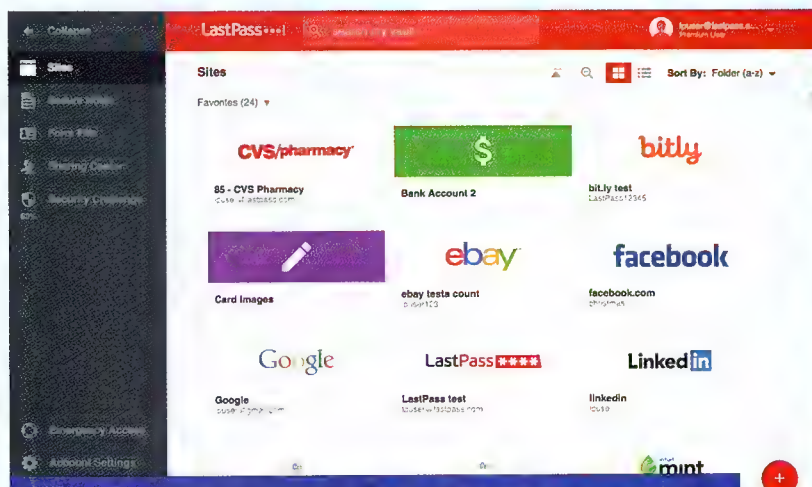
compute the required possibilities to crack it, though as computers become more powerful, this continually reduces.

Apps and extensions

Though there is a bit of setup initially with password managers, if you set them up properly, then they should save you time. The way they do this is through smartphone apps and browser extensions that allow you to have access to your password vault wherever it is you generally use them. 1Password is the most limited in terms of ubiquity but it is still available on Chrome, Safari, Firefox and Opera browsers and Android or iOS apps. Considering you can grant them permissions to autofill in smartphone apps or on any web page, both are worth setting up.

Two-factor authentication

Dashlane has a two-factor authentication system of its own that comes preconfigured to use the email account it was set up with, but you can connect it to a range of third-party two-factor authentication apps instead. Lastpass has its own authenticator app, but offers less in the way of third-party compatibility. Interestingly, 1Password doesn't offer two-factor authentication, but the company argues that the locally stored files mean largely cancel out the need for multi-factor authentication.



"The key to a well-formed password is part maths, part randomness and should include more than 8 capitalised and lowercase letters, numbers and symbols and ideally should be created by chance."

Best Windows security suites

Need a security suite for your PC? Nathan Taylor scrutinises our top eight choices.

With cybercriminals getting ever more aggressive, there has never been a better time to get hold of a security suite. The best security suites now provide full-spectrum protection for your system. That means they protect you not just from viruses and hackers, but also from a host of other attacks: phishers, account hacks, scammers, ransomware, Wi-Fi hacks, even crapware.

Here, we've looked at our top three picks of the current security suite market, as well as the next five down.

TEST RESULTS

Each of the suites reviewed here has been comprehensively tested by independent antiviral analysis company AV-Test (www.av-test.org). We've published the latest results available at the time of writing, from June 2016.

The results are not, in all cases, from the specific products we've reviewed. For example, we may have reviewed the full suite where AV-Test may have only tested the standalone antivirus application, or we may have a product that has been updated since the tests were performed in June. That doesn't change the validity of the results, since the same antivirus engine is in use. Let's break down what the numbers mean:

- Protection against 0-day malware attacks is a measure of the suite's ability to detect new viruses based on their behaviour. It's perhaps the most important number here.
- Detection of widespread and prevalent malware shows the detection percentage of known viruses released in the four weeks before the test.
- The performance impact ratings give percentages by which the suite slows down a high-end PC when performing common tasks. (Note that we used results from a high-end PC since they tend to be more notable).
- False warnings is the number of instances where the suite flagged legitimate software and web sites as a threat and either blocked it or produced a warning popup.

For convenience, AV-Test also provides three overall scores, rating each suite's protection, performance impact and usability out of six, to give a total score out of 18. (Usability, in this instance, is not a reference to ease-of-use, but based on the number of times the program produced false popups and blocked legitimate software). We should note that AV-Test's aggregate scores are based on combined May-June performance, while we've only printed June results for space reasons.

We also don't have room here to review every antivirus product tested. We limited ourselves to the suites that we currently think are the top picks based on both their test results, features, usability and value for money.



\$95 FOR 3 PCS FOR 1 YEAR | WWW.BITDEFENDER.COM.AU

BitDefender Internet Security 2017

Still the best.

Although it has been knocked off the top of the anti-malware performance ranking in the most recent AV-Test benchmarks, BitDefender remains our top choice suite for 2016/2017.

The most recent version, 2017, hasn't added much – the only new thing is an updated interface and the Wi-Fi security advisor, a tool that warns you if you're on an insecure public or private Wi-Fi network. However, the feature set of BitDefender remains pretty incredible.

The suite includes all your regular features – firewall, anti-spam and anti-malware, but that's just the beginning. There's an actually useful website checker, system optimiser, secure browser, password manager, file shredder and application update checker.

In 2016, it introduced ransomware protection, which let you lock files and directories to prevent deletion by ransomware. There's also the excellent

parental control systems, which come close to those provided by Symantec, including cloud management of access on multiple devices and the ability to trigger malware scans on devices attached to the licence.

We've found that BitDefender has one of the best malware removal systems thanks to a rescue mode, where it reboots the system into a special mode to remove rootkits.

BitDefender also offers several other options for buyers – Total Security Multi-Device; Family Pack; and an installation service for \$90, where a BitDefender technician will remote desktop to your PC to set up the suite for you.

Verdict

Excellence across the board.





\$100 FOR 3 DEVICES FOR 1 YEAR | WWW.KASPERSKY.COM.AU

Kaspersky Total Security

Top ranking anti-malware.

For several years now, Kaspersky has been in perennial second place in our rankings. This year, we're prepared to put it on par with BitDefender: it's not as smooth overall, and doesn't have the quality of extra features, but its unrivalled anti-malware performance makes up for it.

In the benchmarks, it had perfect detection and removal rates, yet still had only a modest impact on system performance. For a suite to be both the best and nearly the lightest is a major feat. There are privacy and web protections; a firewall and anti-spam; a secure browser for banking and shopping; a solid password manager with syncing across multiple devices; file encryption and backup; system optimisation; and a much improved parental control system that includes managed protection and monitoring across both PC and mobile platforms.

There's a new application version checker, which will

silently update important apps like Flash and Java; and an installation checker and software cleaner function, helping defend your system against crapware. Perhaps most significant, however, is 'Secure Connection', a VPN service that the suite will start up when it detects that you're connected to an insecure Wi-Fi network.

Given all the features, Kaspersky can be a little overwhelming to manage, and in spite of an updated interface is less user-friendly than BitDefender.

However, we've found it doesn't have many management requirements, essentially running primarily on autopilot – which is pretty much how we want our suites to run.

Verdict

All the components are excellent. A fantastic suite.



\$90 FOR 3 DEVICES FOR 1 YEAR | AU.NORTON.COM

Norton Security Premium for Three Devices

Made for families.

Norton Security Premium does a lot in the background, but it doesn't bother you with many of the details – it just fixes things that need fixing. In terms of anti-malware performance, it's up there with the best. It had perfect detection rates in AV-Test's benchmarks, its overall rating only let down by the modest impact it had on performance.

The list of features is extensive, with the elegant identity theft protection, password manager and startup manager being particular highlights. Then there's the suite's secret weapon: Norton Family. Norton Family is, bar none, the best parental control system going, and the suite gives you access to the premium features of the service. It's more than just blocking sites; it's about managing access, reporting on activity and providing samples of the kinds of contents your kids are viewing. It's all elegantly

managed through a browser interface, so you don't need to personally manage every tablet and phone.

The suite also comes with a capable backup tool and 25GB of cloud storage, which is a nice bonus. Although it doesn't quite have the powerhouse feature set possessed by BitDefender and Kaspersky, the simplicity and features of Norton make it a great family purchase.

The company also offers a single-device version of Premium for \$60, which doesn't have the parental controls and only has 2GB of cloud storage; as well as a five-device household licence, which was actually priced the same as the three-device licence at the time of writing.

Verdict

With excellent parental controls and backup, Norton Security Premium has a lot to offer.



super

» windows security suites

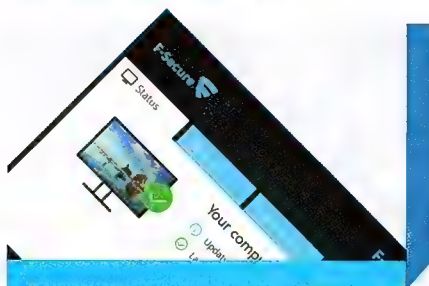


AVG Ultimate

Have heaps of devices?

\$105.79 FOR UNLIMITED DEVICES
WWW.AVG.COM

Although it's not loaded with features like BitDefender or Kaspersky, we're loving the new AVG Ultimate, which is built to make managing a lot of devices – including mobile devices – very easy. It has an unlimited device licence for a single household and you can view and manage them all from a single PC. It also proved to have fantastic antivirus performance in the recent benchmarks.



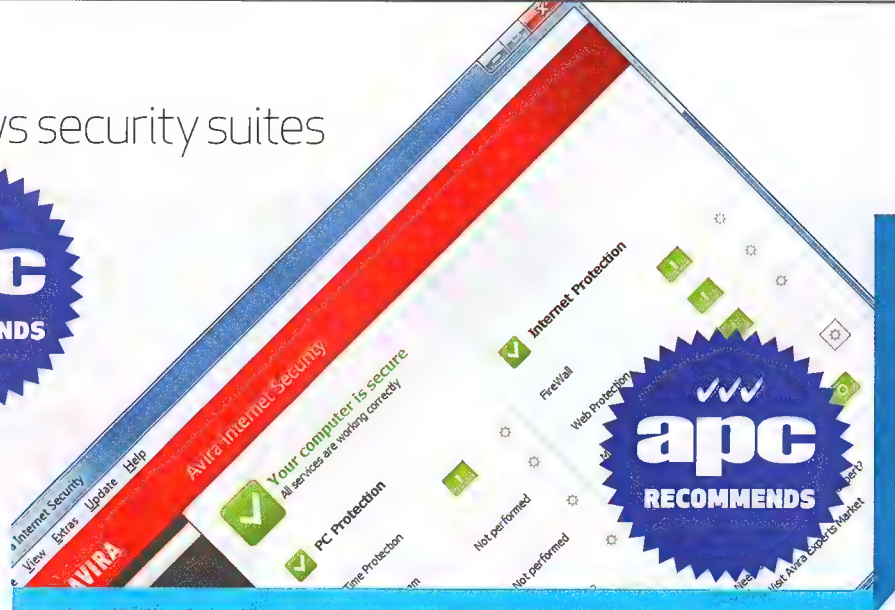
F-Secure Total Security and Privacy

Protection and VPN.

€79.99 FOR 3 DEVICES FOR 1 YEAR
WWW.F-SECURE.COM

While F-Secure hasn't quite kept up with some of the other suite makers in terms of features, both its stellar performance and unlimited VPN service make it worth consideration.

The suite is a combination of the Freedom VPN service and SAFE, a multi-platform package that includes your regular anti-malware, anti-spam and firewall as well as secure browser, parental controls and anti-theft. Combined with an unlimited, fast VPN service, it's a pretty good deal.



Avira Total Security Suite

Includes a full, no-limits VPN too.

\$134.95 FOR 3 DEVICES FOR 1 YEAR | WWW.AVIRA.COM

In addition to its stellar anti-malware performance, Avira's Total Security Suite has some great features that really set it apart. While the suite is something of a hodge-podge of components rather than a slickly integrated solution like BitDefender, collectively, those components add up to something pretty great.

Of particular note is the VPN service that comes with the Total Security Suite. Unlike Kaspersky's VPN, this is the full deal, with no daily limits on data usage – which makes it alone almost worth the sub price for the suite. There are also some very solid system optimisation tools and an excellent secure browser.



Intel Security McAfee Internet Security

Easy-to-use protection.

\$100 FOR UNLIMITED DEVICES
WWW.MCAFEE.COM

The McAfee suite provides a slick, easy-to-use solution that asks almost nothing of the user. The web protection and password managers remain particular highlights of this suite, as does the particularly low demands it places on the host system. The best thing about it, however, is the unlimited device licence model that several other vendors have now copied. All your PCs, mobiles and tablets are covered by this single licence, which makes it a great deal for families.



Trend Micro Maximum Security

Greatly improved.

\$79.95 FOR 6 DEVICES FOR 1 YEAR
WWW.TRENDMICRO.COM.AU

Trend Micro has introduced elements like a much-needed anti-ransomware tool (similar to that in BitDefender) as well as improving its mobile support, social networking protections and password management.

All the suite's features are wrapped in a very usable, very accessible interface on both desktop and mobile. Best of all: it performed extremely well in the anti-malware benchmarks, with excellent detection and only slight impact on system performance.



VENDOR / SPECIFIC PRODUCT TESTED	AVAST FREE ANTIVIRUS 2016	AVG INTERNET SECURITY 2016	AVIRA ANTIVIRUS PRO 2016	BIT-DEFENDER INTERNET SECURITY 2016	BULLGUARD INTERNET SECURITY 16	ESET SMART SECURITY 9.0	F-SECURE SAFE 2016	KASPERSKY LAB INTERNET SECURITY 2016	INTEL SECURITY MCAFFEE INTERNET SECURITY 2016	MICROSOFT WINDOWS DEFENDER 4.8	PANDA SECURITY FREE ANTI- VIRUS 16.1	SYMANTEC NORTON SECURITY 2016	TREND MICRO INTERNET SECURITY 2016
PROTECTION AGAINST 0-DAY MALWARE ATTACKS	97.3%	100%	100%	100%	100%	100%	100%	100%	100%	97.3%	98.6%	100%	100%
DETECTION OF WIDE- SPREAD AND PREVALENT MALWARE	99.9%	99.4%	99.3%	100%	100%	99.0%	100%	100%	99.6%	99.3%	99.8%	100%	100%
PERFORMANCE IMPACT WHEN LAUNCHING POPULAR WEBSITES	19%	31%	13%	25%	24%	20%	11%	16%	15%	9%	15%	29%	10%
PERFORMANCE IMPACT ON DOWNLOAD OF FREQUENTLY-USED APPLICATIONS	17%	1%	1%	1%	7%	4%	1%	8%	1%	1%	10%	0%	0%
PERFORMANCE IMPACT ON LAUNCH OF STANDARD SOFTWARE APPLICATIONS	36%	7%	10%	13%	12%	9%	8%	8%	16%	17%	35%	19%	19%
PERFORMANCE IMPACT ON INSTALLATION OF FREQUENTLY-USED APPLICATIONS	27%	22%	10%	8%	16%	31%	20%	22%	17%	39%	41%	28%	13%
PERFORMANCE IMPACT ON COPYING OF FILES, LO- CALLY AND IN A NETWORK	40%	8%	2%	3%	2%	32%	6%	3%	3%	1%	19%	4%	3%
FALSE WARNINGS ON IN- STALLING NEW SOFTWARE	0	0	3	4	4	0	6	0	0	1	1	2	2
FALSE BLOCKAGES OF CERTAIN ACTIONS CARRIED OUT WHILST INSTALLING AND USING LEGITIMATE SOFTWARE	0	0	0	0	1	0	3	0	0	0	0	0	0
PROTECTION SCORE	5.5	6.0	5.5	5.5	5.5	5.0	6.0	6.0	5.0	4.0	5.5	6.0	5.5
PERFORMANCE SCORE	4.5	5.5	6.0	6.0	5.5	5.0	6.0	6.0	5.5	5.5	4.5	5.5	6.0
USABILITY SCORE	6.0	6.0	5.5	5.5	5.0	6.0	4.0	6.0	6.0	5.5	6.0	6.0	6.0
TOTAL SCORE	16.0	17.5	17.0	17.0	16.0	16.0	16.0	18.0	16.5	15.0	16.0	17.5	17.5

NOTES: TESTED IN JUNE 2016 ON WINDOWS 8. ALL THE SUITES ABOVE PRODUCED ZERO FALSE WARNINGS CONCERNING CERTAIN ACTIONS CARRIED OUT WHILST INSTALLING AND USING LEGITIMATE SOFTWARE AND ZERO FALSE WARNINGS OR BLOCKAGES WHEN VISITING WEBSITES

ANDROID SECURITY SUITES — FEATURES LIST										
	360 SECURITY -ANTIVIRUS BOOST	MCAFFEE SEC- URITY	SOPHOS FREE ANTIVIRUS AND SECURITY	AVAST MOBILE SECURITY	AVIRA ANTI- VIRUS SECURITY	BITDEFENDER MOBILE SECURITY & ANTIVIRUS	BULLGUARD MO- BILE SECURITY AND ANTIVIRUS	ESET MOBILE SECURITY AND ANTIVIRUS	KASPERSKY ANTIVIRUS & SECURITY	
ANTI THEFT	✓	✓	✓		✓	✓	✓	✓	✓	
CALL BLOCKER	✓	✓	✓	✓	✓		✓	✓	✓	
MESSAGE FILTER	✓		✓	✓			✓	✓	✓	
SAFE BROWSING	✓	✓	✓	✓	✓	✓		✓	✓	
PARENTAL CONTROL			✓				✓			
BACKUP		✓					✓			
ENCRYPTION			✓							
APP LOCK		✓	✓	✓	✓	✓				
PRIVACY ADVICE	✓	✓	✓	✓	✓	✓			✓	
SECURITY AUDIT			✓					✓		
BATTERY OPTIMISER		✓								
WIFI SECURITY				✓						
TEXT PROTECTION									✓	

Best Android security suites

The most widely used operating system in the world is far from invulnerable. Lindsay Handmer reveals the best security systems for your Android devices.

Last year, Android accounted for 76% of all smartphones sold, totalling over 1 billion devices. With a large variety of hardware and OS versions (not to mention slow security updates), Android is increasingly being exploited by malware. Unlike self-replicating computer viruses, Android security problems are mostly from malicious apps, or external phishing or other security threats.

Google actually scans 200 million+ Android apps (via Google Play) each day, and finds problems on less than 1% of devices. Most of those are from users loading apps from less secure stores, not Google Play. While Android has a whole range of built-in protections, many companies have released their own antivirus apps. Stopping malware is a key goal, but they also bring loads of extra features, from privacy setting advice and backups, to call blocking or text message phishing protection. The best Android antivirus apps also run quietly in the background, are easy to use and have little to no impact on performance or battery life.

Despite all the excellent offerings, picking the best app can be tricky. Most are offered with basic free versions, and paid or subscription upgrades to unlock extra features. The very best offer all (or almost all) features for free to consumers, and make their money from paying corporate clients. We have reviewed our favourites, but it is worth trying a few to see how it runs on your particular device, and which features are most useful. Don't forget to check out Android's built-in security, such as tracking and remote wipes via Android Device Manager.

HOW WE TESTED

Using antivirus testing results from av-test.org, we compiled a list of 20 apps with the best average detection rates in 2016. We then tested the usability and features of the 20 apps, using a Nexus 6P running Android 7.0. Based on malware detection rates and hands-on testing, we chose the best three apps to highlight as the top picks, alongside six more that are almost as good and could be worth checking out, depending on your particular needs. You can also find a full list of features for each Android security app on the previous page – for the sake of saving space, we've combined them on the same page as the Windows test results.



FREE | WWW.360SECURITYAPPS.COM

360 Security — Antivirus Boost

With an amazing 200 million users.

Providing totally free no-strings-attached protection, 360 Security is a great place to start. It is ad supported, but they are very unobtrusive. Just as importantly, it picked up 100% of malware in ongoing tests dating back over two years, which is an extremely impressive result.

The app includes the usual real-time protection that scans apps as they are installed, but of course can also run full scans of internal and SD storage at any time. 360 Security can help protect your personal data, such as messages and photos, from being accessible to other people and apps, and includes an app locker. For those who are worried about losing their device completely, 360 Security a suite of anti-theft features, including remote locking and erasure, and locator and alarm, all accessible via a web interface. It also has the usual array of call and SMS

filters to block unwanted contact.

While not strictly security related, the app has a bunch of handy extra features. It can help clear up junk files to increase storage space, better manage battery life and clear memory. While a bit gimmicky and perhaps not needed, many users appreciate the extra options.

360 Security offers a very clean and well-designed interface, that makes it easy to navigate without extra clutter. In our testing, it was snappy and fast and ran seamlessly in the background.

About the only annoyance was ending up with three different icons installed for the one overall app.

Verdict

Top-notch protection and features for free.





FREE | WWW.MCAFEE.COM

McAfee Security

High-end, free features.

A very well-known name, McAfee Security offers a comprehensive array of free features. It's supported by ads, and there is also a premium paid upgrade with a few extra options. McAfee LiveSafe and All Access paid users get the premium version for free. McAfee is actually owned by Intel and is part of the security division. While the app detected 100% of the malware in the most recent testing, older rounds saw it achieve slightly lower but still incredible good detection ratios of 99.7%+.

McAfee Security has a comprehensive anti-theft solution built in, including tracking, remote wipes, backups and image recording. Of course, it also provides protection against malicious apps and files, and blocks dodgy websites and unsecure Wi-Fi networks. The app has a strong focus on privacy, with an applocker, call and SMS filters, and advice on what

apps can access your personal information. McAfee also has performance optimisation, which can help make better use of data, battery life, memory and storage space.

McAfee Security is slick and fast in use, and we didn't notice any loss of performance. It's also quite well laid out, and easy to use for both beginners and the more tech savvy. As much as we hate ads, they are quite unobtrusive, and a small price to not pay. One downside is that McAfee quite aggressively pushes the paid upgrades – though there is a 'no credit card required' 30-day trial. The extra features are only phone support, no ads and backups that include media files.

Verdict

Free and easy to use, yet fully featured.



FREE | WWW.SOPHOS.COM

Sophos Free Antivirus and Security

Fully-featured and totally free.

Unlike some of the competition, Sophos don't mess around with different app versions, or paid upgrades. For normal users, it's free to use with no ads or other strings attached. Instead, the company makes its money from commercial and government operators. Impressively, Sophos consistently picks up 100% of malware (and no false positives), and has done so all through 2015 and 2016 so far.

Sophos checks apps as they are installed, but can also schedule scans for inbuilt and SD storage. It has its own tracking and remote wipe options, though they are not quite as fully featured as some of the competition – such as no photo taking. The app also provides spam call blocking, automatic checking and filtering of suspect websites, SMS messages and even QR codes. Sophos can lock apps with a password, as well as advise of security and

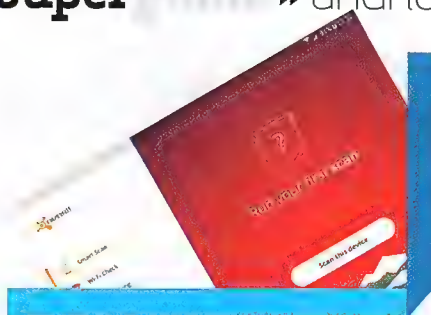
privacy settings concerns, and report apps that could create unwanted costs. Just about the only feature it does not have (that other apps do) is a backup system – but considering plenty of other free apps offer this, as well as Android itself, it's no great loss.

Sophos is extremely well put together, and is easy to get started, but also offers a wealth of more in-depth settings for those who like to have Android set up just so. In our testing, we didn't experience any lag or performance hits, even when scanning. AV-test.org gives Sophos a 100% score for usability, and gave it the best protection award in 2015.

Verdict

Easily the best Android security app available, and all for free.



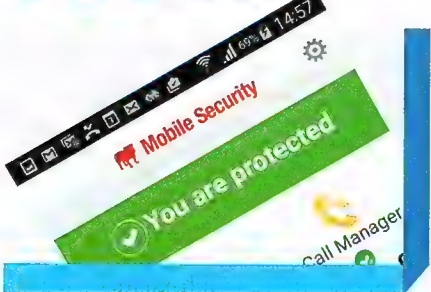


Avast Mobile Security

Now totally free on Android.

FREE | [AVAST.COM](http://www.avast.com)

One of the few apps we tested without a 100% protection score, Avast still has a better-than-average 99.7% detection rate. Features that were once a paid upgrade are now free (though no anti-theft), thanks to slightly annoying but worth it ads. Avast offers malware scanning, app locking, app permission checker, call and SMS blocking, website and Wi-Fi protection and more. Importantly, the app is also straightforward to use, and doesn't impact performance or battery life.



Bullguard Mobile Security and Antivirus

Total device security
\$14.95 A YEAR | [WWW.BULLGUARD.COM](http://www.bullguard.com)

Bullguard Mobile Security and Antivirus picks up 100% of malware with real-time and scheduled scans. The app has anti-theft tracking and alarms, as well as performing a wipe if the simcard is replaced. It can filter unwanted calls and messages, and gives remote web-based management of your security. It also performs easy one-tap backups. There is also a premium version (\$24.95) that includes quite comprehensive parental controls and works on up to five devices.

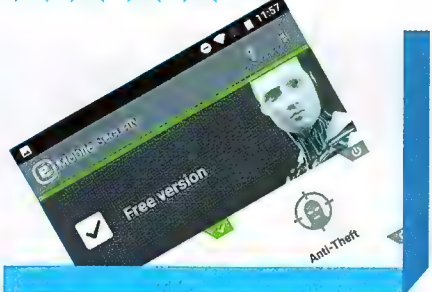


Avira Antivirus Security

With tens of millions of installs.

FREE | [WWW.AVAST.COM](http://www.avast.com)

Boasting a 100% detection rate, Avira offers very comprehensive malware protection for free, with a not needed paid upgrade. It doesn't skimp on other features either, with built in anti-theft and remote device tracking and management. It's also got an applocker, call and SMS filter, and can check app privacy permissions to help avoid any unwanted data loss. Handily, it can also monitor whether your (or your contacts') emails have been leaked in a third-party data breach.



ESET Mobile Security and Antivirus

Easy malware protection
FREE | [WWW.ESET.COM](http://www.eset.com)

ESET offers a core of free Android security, with a 100% detection rate. It includes automatic and on-demand scanning, as well anti-theft remote tracking and management. The paid premium version (\$14.95, 30-day trial for free) gives a proactive anti-theft system, online management, browser protection, app audits, SMS and call blocking and battery saving. But the core free features are perfect for those who just want easy to use malware protection without all the fluff.



Bitdefender Mobile Security & Antivirus

Is it worth paying?

FREE | [WWW.AVIRA.COM](http://www.avira.com)

While we focus on and love free protection, Bitdefender stands out as one of the better paid apps available. It's free to try for 14 days, after which it costs \$14.95 a year. For that small fee, it provides a wealth of features, such as a 100% detection malware scanner, web security, privacy adviser, anti-theft with photo taking, smart unlock and an applocker. For those with a smart watch, Bitdefender extends the security with WearON.



Kaspersky Antivirus & Security

Amongst the best
\$24.95 A YEAR | [WWW.KASPERSKY.COM](http://www.kaspersky.com)

So close to our top three, Kaspersky offers 100% malware detection in a simple yet powerful package. The free version includes scanning, privacy protection, web security, SMS and call blocking, and anti-theft. The only downside is that it holds out real-time scanning for the premium paid versions, along with deeper privacy and web protection. The app costs \$24.95 a year for the upgrade, but gives protection to three mobile devices.





WHAT'S THE NEXT
MUST-HAVE
ON YOUR GADGET WISHLIST?

WAIT NO MORE. GRAB THAT LATEST TECH WITH GREATEST SAVINGS.
WWW.GETPRICE.COM.AU

GETPRICE



DIY free security toolkit

Make your own security suite with Nathan Taylor.

So you're not keen on paying \$100 per year for software security? It's easy enough to create your own suite with the right set of free apps. Below, we've listed our top free security apps by category — just install a selection of these and you'll have a free toolkit all of your own making.

ANTI-MALWARE: AVAST FREE ANTIVIRUS

www.avast.com

A lot of the major anti-virus companies offer free anti-malware now, but none of the other free apps offer quite as many features as Avast.

It removes potentially unwanted applications (PUPs) as well as malware; it checks for and manages software updates for other applications, it has a system optimiser and a performance scanner, a rescue disk, web protection, and it has an inbuilt password manager. (When it comes to the latter, we still prefer to use LastPass but if you're not interested in having another app then this gets the job done.)

FIREWALL: GLASSWIRE FREE

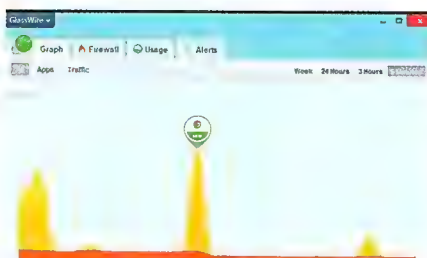
www.glasswire.com

While Windows Firewall is perfectly fine, if you really want a top-class firewall, you should check out GlassWire Free. The reporting functions of GlassWire are miles ahead of Windows' Firewall, with full reports of all network activity for 30 days, broken down by user, app and location. It can monitor usage and send alerts if you're in danger of going over your monthly download quota, and you can even monitor several computers and devices at once from a single PC.

ANTI-TRACKING: DISCONNECT BASIC

disconnect.me

Disconnect Basic is an essential browser add-on for Chrome, Firefox,



GlassWire is an improvement over Windows Firewall in all areas.

Safari and Opera. Its core function is to block your browser from talking to services you probably don't want it talking to. It blocks social media widgets that can be used to track you and prevents third-party tracking cookies from advertising agencies. It also tries to force HTTPS, ensuring as many connections as possible have end-to-end encryption.

PASSWORD MANAGER: LASTPASS

lastpass.com

The world's most popular password manager is still our go-to recommendation. A cloud-based service that you can install on multiple devices (though syncing to mobile platforms requires a US\$1 per month sub), LastPass has all the features you could ask for in a password manager. It supports two-factor authentication, including Google Authenticator, and all encryption/decryption is done locally, so you don't have to worry about LastPass getting hacked.

BACKUP: CODE42 CRASHPLAN

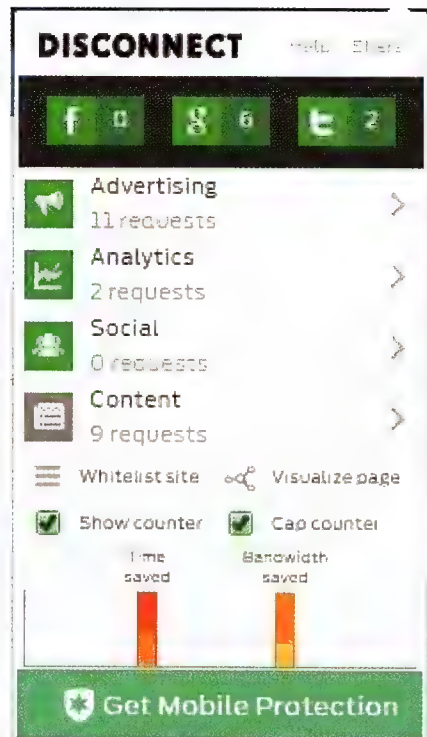
www.crashplan.com

Although we're not happy with some of the recent changes and restrictions placed on the app, CrashPlan's unique ability to create backups across multiple PCs still makes it our top pick. You can back up your system to another PC running CrashPlan, and that other PC can back up to yours, for example. It's a very clever system, and available for free. Code42 only charges for the optional cloud backup.

PARENTAL CONTROLS: NORTON FAMILY BASIC

family.norton.com

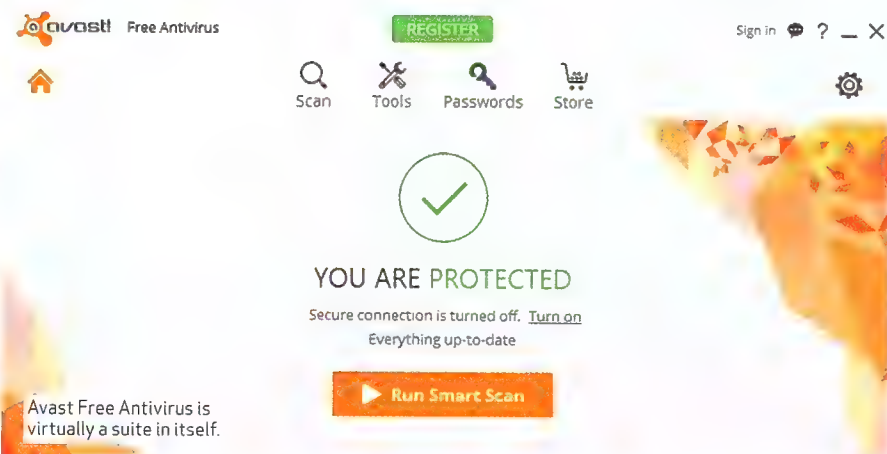
It used to be the case that free parental



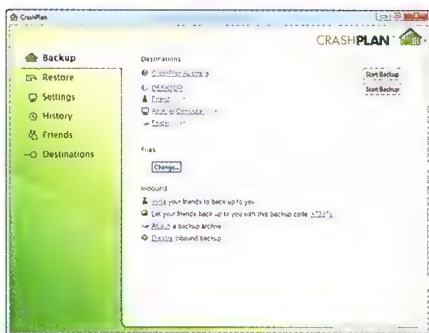
Disconnect Basic is a browser add-on that stops web sites from tracking you.

control solutions were simply terrible. No more — there are actually a number of free solutions around now that do a great job of managing your kids' internet activity. Of those, Norton Family remains a top pick for us, even though Norton has recently reduced the features it offers for free.

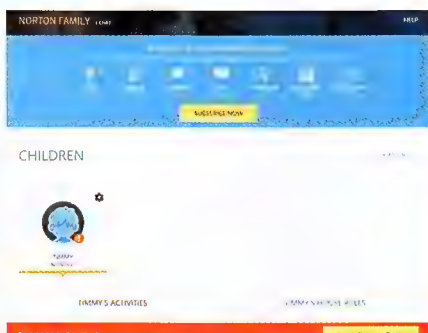
Like the best parental control applications, it's about working with your child to manage online activity. It does block inappropriate sites, but it also provides reports on what sites they're visiting and how much time



Avast Free Antivirus is virtually a suite in itself.



CrashPlan's unique destination system makes it a top backup solution.



The free version of Norton Family is more restrictive than it used to be, but it's still worth getting.

"It does block inappropriate sites, but it also provides reports on what sites they're visiting and how much time they're spending on certain activities"

they're spending on certain activities. As an alternative to Norton, you can also try OpenDNS Family Shield (www.opendns.com/home-internet-security), a tool that uses DNS to block sites. You can set it up on a router so that all the devices in your home are covered.

SECURE BROWSER: EPIC PRIVACY BROWSER

www.epicbrowser.com

Based on Chromium (the browser engine used by Chrome), Epic Privacy Browser is built to protect you against all the ways that your web browser can sell you out. It blocks tracking scripts and cookies in much the same way that Disconnect does, runs incognito mode by default, forces HTTPS, and even does things like stop Google URL checks and installation IDs. All your web searches are routed through a

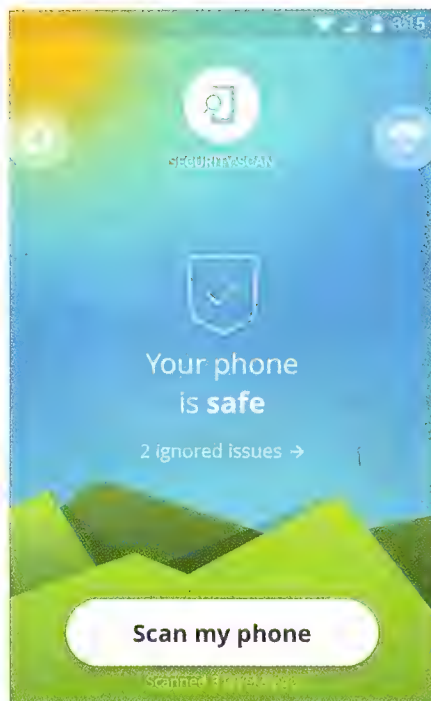
proxy to anonymise them and it even includes a proxy service for access to otherwise restricted sites.

MOBILE SECURITY: AVAST MOBILE SECURITY & ANTIVIRUS

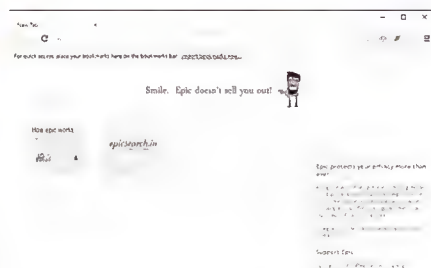
www.avast.com/free-mobile-security

Much like its free desktop solution, Avast's free Android security app offers more features than many paid apps. It includes a malware scan, of course, and there's also a call blocker (preventing selected numbers from calling), an application permission check, Wi-Fi security notifications and the ability to password protect apps.

What it does not include is a phone tracker or anti-theft tool, presumably because these days, Google and Apple have that pretty well covered already with Android Device Manager and Find My iPhone.



Avast's Mobile Security & Antivirus covers a lot of bases.



Epic privacy browser is perfect for when you don't want to be tracked online.

If Avast is not doing it for you, then we can also recommend NQ Mobile Security (www.nq.com) as an excellent alternative. It adds both safe browsing and anti-theft.

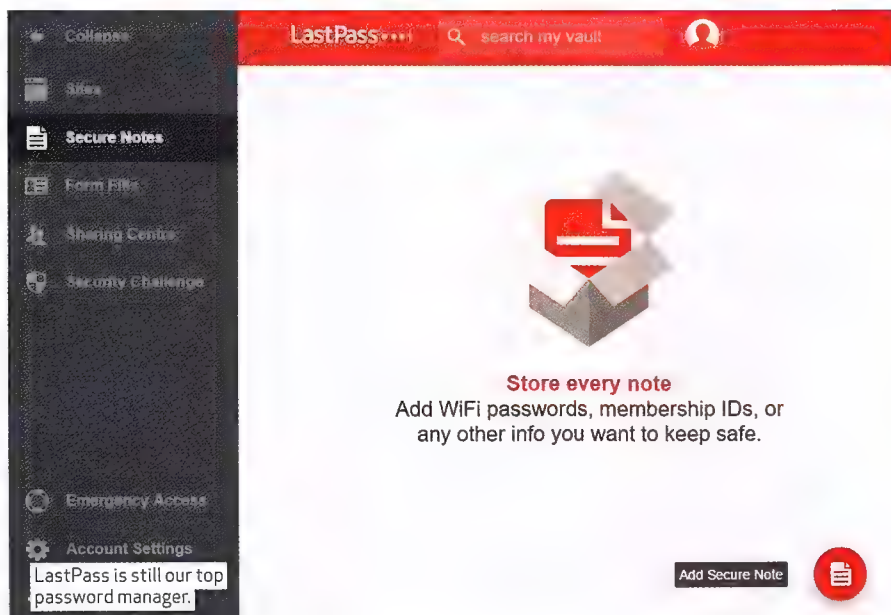
OTHER USEFUL APPS

This list is certainly not exhaustive. Here are some of our favourite extra apps you can try:

CCleaner (www.piriform.com/ccleaner), a top tool for clearing the gunk off your PC. It clears cookies, unwanted apps, old registry entries and unwanted startup objects.

BitDefender Clueful Privacy Advisor (bitdefender.com), which does a better job than anyone of evaluating risky apps you might have installed on your phone or tablet.

Unchecky (unchecky.com), a simple app designed to keep you system clear of unwanted apps. Whenever a new app you install provides an 'offer' (in other words, crapware you don't want), Unchecky will automatically uncheck the option to install it.



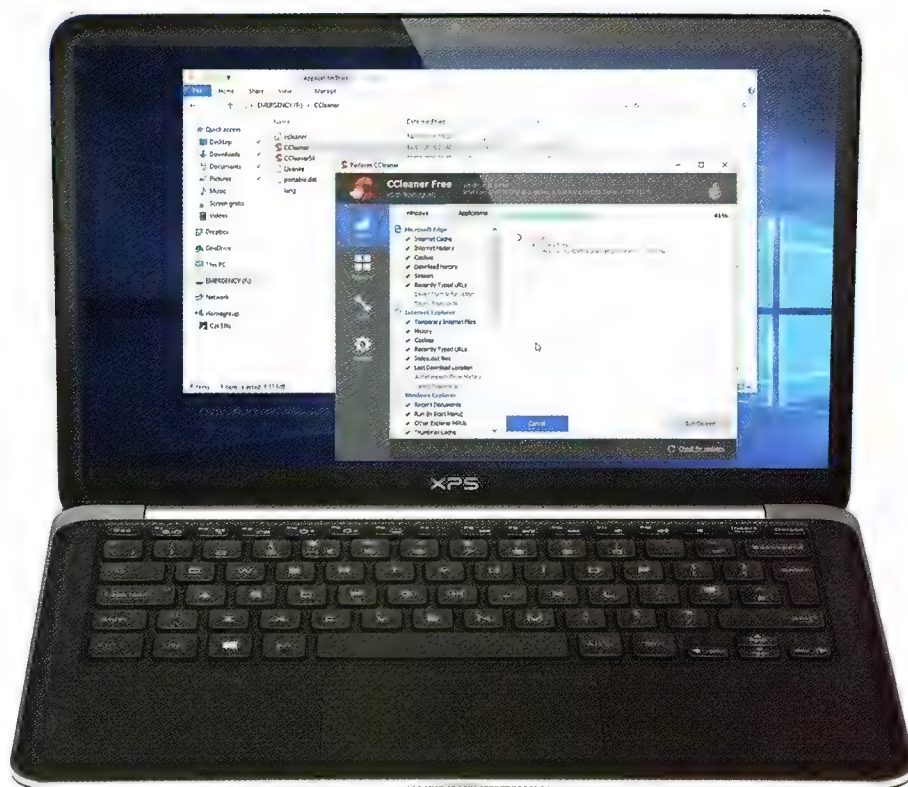
Create an emergency USB stick

Cat Ellis shows how to put together all the essential apps you'll need to deal with potential PC disasters.

Viruses, malware, accidental deletion or corrupted data can all put your valuable files at risk.

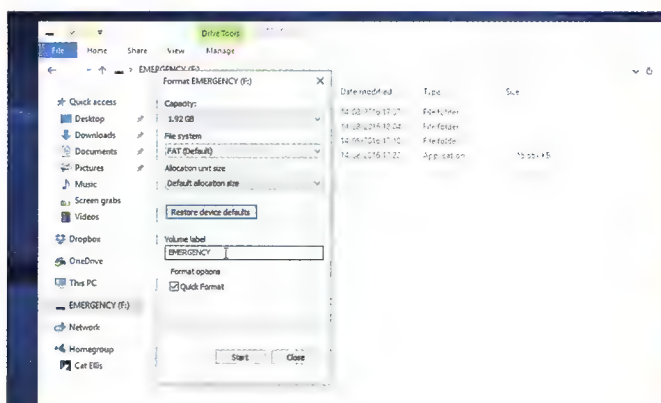
The best insurance is to make regular backups, but what if you run into trouble in between backups, or you let your routine slide, or a friend has a crisis with their PC? That's where an emergency USB toolkit of portable apps comes in, giving you everything you need to fix the damage and save the day.

When you install a program, not only are the files it needs to run saved on your hard drive, it also makes its own changes to the rest of your system — such as adding entries to the Windows registry. Portable apps don't do this, meaning you can save them to a USB stick and use them on any PC by double-clicking the program's EXE file. We've put together a collection of the best ones for use in emergencies.



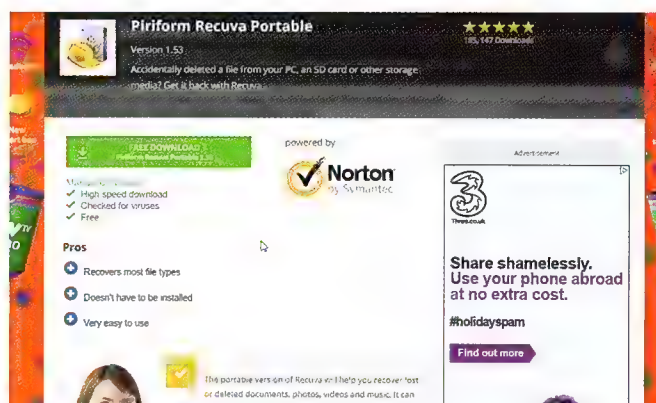
Step-by-step

Be ready for PC emergencies with this USB toolkit



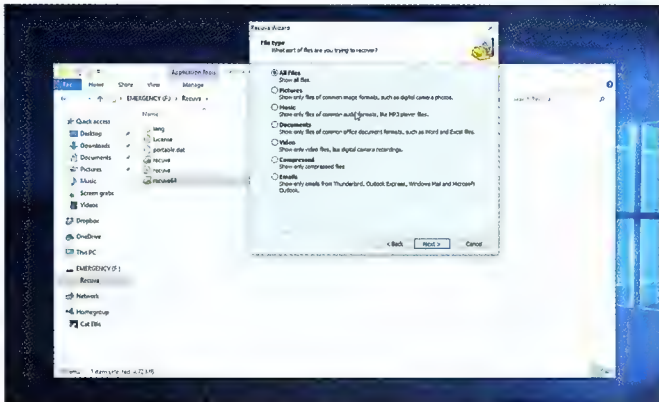
PREPARE YOUR USB STICK

First, you'll need a USB memory stick — 1GB will be fine. Plug it into your PC and open Windows Explorer, then right-click it in the menu on the left, select 'Rename' and name it 'Emergency'. If you've used the memory stick before, you can wipe it by right-clicking it and selecting 'Format > Restore device defaults > OK'. Make sure there isn't anything you want to keep on the stick first.



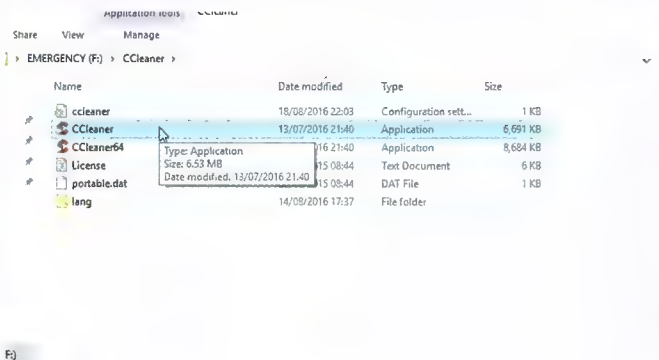
PREPARE FOR ACCIDENTS

Now to build our toolkit. A common disaster is accidentally deleting a file — from your hard drive, an SD card or other storage. Piriform Recuva can help you get it back, but installing this after you've lost files can result in them being overwritten. It's far better to have it ready to run from your USB stick. Download it from www.piriform.com/recuva — using 'Manual download' is easiest.



3 RECOVER DELETED FILES

Click the downloaded ZIP file in your browser, and select 'Extract > Extract all'. Click 'Browse' and select your USB stick. Right-click and create a folder called 'Recuva' (to make it easier to find in future). Open this folder and click 'Select folder > Extract'. Now if you ever need to restore a deleted file, just plug in your USB stick, double-click Recuva.exe and follow the instructions.



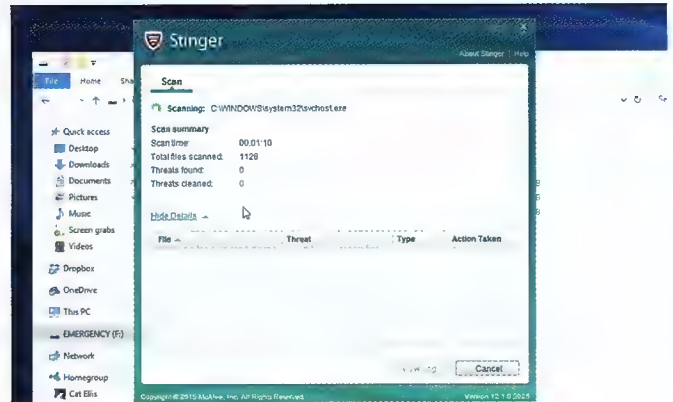
4 GET READY FOR A DEEP CLEAN

If your PC is running slow, or you're getting error messages about corrupted files, CCleaner can save the day. Download it from www.piriform.com/ccleaner/builds (it's the second link), then extract the downloaded file to your USB stick just as you did for Recuva, saving it in a new folder called 'CCleaner'. To run it, double-click the file CCleaner.exe.

	Date modified	Type	Size
	02/09/2016 02:07	File folder	
	02/09/2016 02:07	File folder	
	14/08/2016 18:17	File folder	
	14/08/2016 18:17	File folder	
	14/08/2016 18:49	Configuration sett...	6 KB
	14 08:2016 18:49	Configuration sett...	1 KB
	09/12/2015 09:23	Text Document	5 KB
ie Scanner	27/06/2016 20:52	Application	3,851 KB
it Scanner	27/06/2016 20:52	Application	3,883 KB

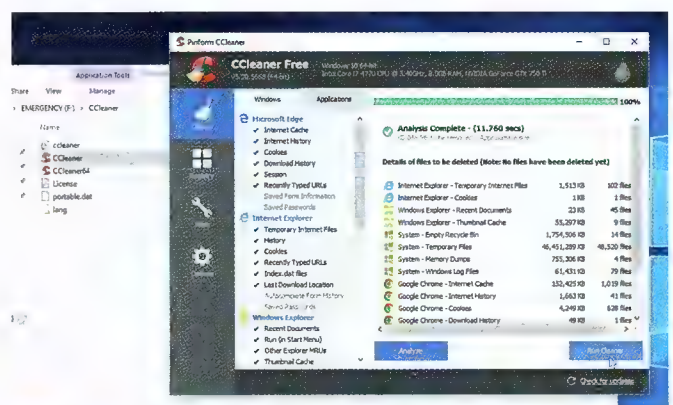
7 GET SET TO BLAST MALWARE

Emsisoft Emergency Kit, from www.emsisoft.com/en/software/eeek, will check your PC for programs that aren't strictly viruses but are still malicious. Double-click the downloaded file and it will run an installer, which automates the process of extracting the files from a ZIP archive. Select your USB stick as the destination, make a folder called Emsisoft and click 'OK'.



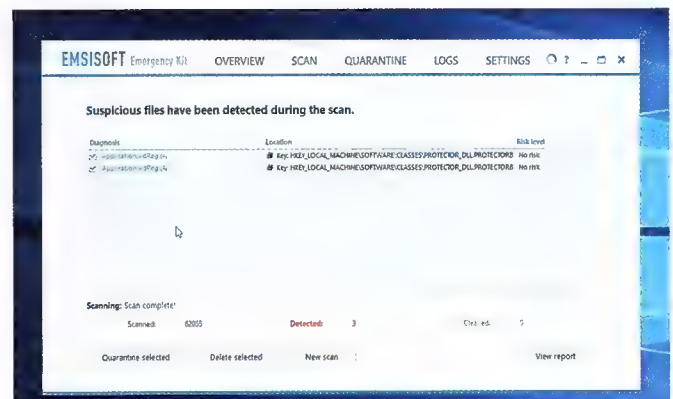
5 DOWNLOAD A VIRUS-ZAPPER

If you suspect your PC has a virus, McAfee Labs Stinger can help stop it in its tracks. Download it from www.mcafee.com/uk/downloads/free-tools/stinger.aspx. This program doesn't come in a ZIP archive, so once it's downloaded, you can drag the EXE file straight to your USB stick using Windows Explorer. When you want to run it, just double-click the file and click 'Scan'.



6 SWEEP AWAY JUNK AND FIX ERRORS

To free up extra space and improve performance, click 'Analyze' and CCleaner will search your hard drive for unnecessary files. Once it's finished, look through the list, uncheck the boxes next to anything you want to keep, then click 'Run Cleaner'. To solve errors with the Windows registry, select 'Registry' from the menu on the left and select 'Scan for issues > Fix selected issues'.



8 READY FOR ANYTHING

Double-click 'Start Emergency Kit Scanner' and let Emsisoft update itself. Now, whenever you think your PC has a malware infection (you notice unexpected changes to your web browser, for example), insert your USB stick, launch Emsisoft, click 'Scan' and follow the instructions to deal with the issue. Label the USB stick and keep it handy — you never know when you'll need it.

The ultimate Linux-powered home server

Jonni Bidwell shows you how to set up a Debian Linux home server that can enrich your life.



Running Linux on a home computer is something of a rite of passage in some circles, all the more so if you take the leap and make it your main OS. Friends are bemused as the incantations you type give rise to arcane console output, error messages, or pictures of cats.

They ask if they can run Linux, too, and you say something enigmatic like: "I can only show you the door, you must

walk through it." They usually stop being your friends at that point. But that's OK, you don't need friends, you have Linux – and unlike your erstwhile friends, Linux is also a great server OS. And a home server is a great substitute for friends. Well, maybe not, but in this feature, we'll show you how to set up a machine that can safely store your documents, share photos throughout your household, schedule cloud backups, and much more. If

you've never set up such a thing before, fear not – as with many things Linux, the process is much easier now than it used to be. Working outside of a GUI can be intimidating at first, but once the initial setup is done, everything else can be achieved from the desktop.

If you've already done this before, maybe you'll learn some new tricks, and even if you haven't set up Linux before, we've tried to make it simple enough that everyone can follow along.

Building and configuring

Assemble and pray to \$DEITY for the happy beeps. Then install Debian.

Not that long ago, we would have needed to spend a good page talking about hardware considerations. Back then, hardware support was something of a minefield — here, we've squished it all into a box (below).

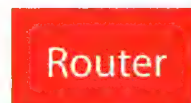
Things still aren't perfect on Linux, but serious hardware incompatibilities tend to be reserved for laptops, so any issues you run into elsewhere are usually pretty minor and easily corrected. In theory, you could cobble any old bits together and make a server, but old components (particularly hard drives and power supplies) have a habit of breaking, and broken is generally not a good state for a server to be in. Further, when these

SSH
Samba
CUPS
Emby
Webmin



192.168.1.100

Our server, the wonderful services it will provide, and its place in the wider network.



192.168.1.1

Client machines (desktops, laptops, phones, and so on)

"Backing up a couple of key configuration files will make this process even easier."

components do break, replacements are often only available second-hand (and often at a vastly inflated price), so may not last long. Also, that 10-year-old IDE drive that's been sitting on your desk all year is unlikely to be fast or capacious enough to be useful. Add to that the fact that old gubbins is inefficient, and tends to get hot and noisy (and nobody likes inefficiency, fires or disturbance), and our 'perils of relying on old hardware' talk is done. By all means use spare parts that you have lying around, but only if you're confident they will last.

We're going to use Debian for our server, though all the packages we refer to are available on other distros, so you can use whatever you like. If you really must, this includes desktop distros, but we have no need of GUIs where we're going. So things like Ubuntu Server, CentOS or Arch Linux are more reasonable choices. We're going to have a really simple partition set up for our OS drive — just an ext4 partition for the OS, and a swap partition — basically, what you get if you accept the defaults on a standard

install. While some people would be tempted to do something more exotic, such as snapshots, rescue partitions, and LVM, we're working on the theory that, if the worst does happen, our configuration will be easy to replicate with a fresh install. Backing up a couple of key configuration files will make this process even easier.

Debian is easy to install — just grab the ISO (either the small Network Install, or the first CD from the install set) from www.debian.org, and away you go. You're prompted to set a password for the root user — setting this to blank disables the root account and installs sudo, which you may prefer. You'll certainly want at least one user account at this stage; others can be added as required (with draconian storage quotas, if you want to be that kind of sysadmin). The 'Guided — use entire disk' option sets up an ext4 and a swap partition, which is all our server needs.

Once everything's installed, reboot into the new system, and log in as root (or your user if you disabled the root account; we'll use the # prompt to indicate commands that require sudo usage). It's good practice to keep your server up to date, so our first act is to update package lists, and catch any last-minute upgrades:

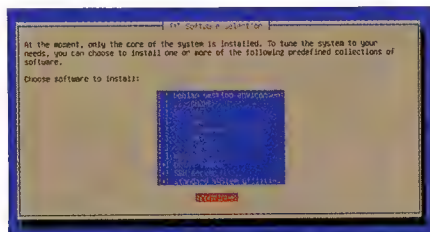
```
# apt-get update
# apt-get upgrade
```

This is the minimal Debian collection set we started with. The installation took up just over a gigabyte.

Hardware

A typical home server doesn't need much processing power — a dual-core Pentium chip is fine, and 4GB of RAM is more than enough. A wired connection is preferable to a wireless one; consider investing in powerline adapters if your server has to live far away from your router. It's worth investing in gigabit Ethernet (which might also entail a home router upgrade), particularly if you envisage lots of data flowing between your server and client machines around your home. Small cases are great for hiding in nooks and crannies, but the popular Mini-ITX cases tend not to be able to accommodate more than one or maybe two 3.5-inch drives, which may be a problem.

We're installing our OS on one drive (ideally an SSD, but it could be a hard drive, or even a fast USB stick), and have a two-drive RAID 1 (mirrored) array for storage. Our OS drive should be at least 20GB; we won't be putting much there, but room to move can be helpful. Large SSDs are expensive, so spinning disks are preferable for terabyte-scale storage. Mirroring drives might seem unnecessary (especially when we tell you that RAID is no substitute for backing up), but failures happen, and servers deserve more caution than a home machine. If you have a different disk strategy in mind, that's fine — these are just guidelines.



Adding a RAID setup

Set up a mirrored array of redundant storage, and then make your server easy to find with a static IP.

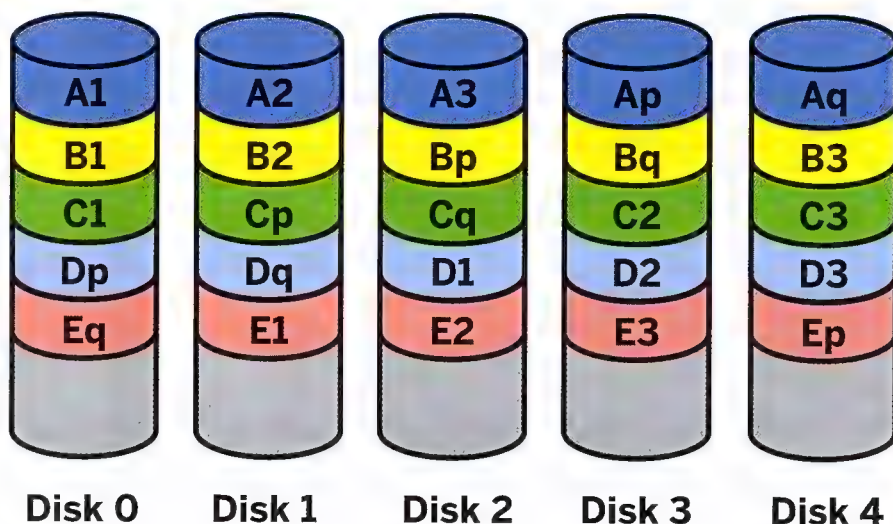
The next step is to set up a software RAID array using `mdadm`. Let's suppose we have two 1TB drives, which can be had for about \$50 a pop nowadays. There is a natural aversion to sacrificing capacity; it would be tempting to have two large partitions (one on each drive), but if one drive fails, you lose half your data, and by Murphy's Law, it will be the good half. You could be even more reckless, and conjoin multiple drives together (JBOD) into a single logical volume, but here, if one drive fails, you lose all your data. Don't hate your data. There's also a common misconception that your drives have to be identical for RAID. This isn't true — in fact, there's a reasonable argument for using different drives, or at least drives from different batches, in case of manufacturing faults.

With the drives connected, check their device nodes by running `lsblk`; it would be inconvenient if we wiped our Debian install. Let's assume our data drives are `/dev/sdb` and `/dev/sdc`. The first step is to partition the drives,

What RAID does and does not protect

With RAID 1, if something goes wrong on our data volume, then we can restore (in the event of a single drive failure), or cry into our soup because we didn't have a backup strategy for two failures in place, and now the whole array is unreadable. That might sound alarmist, but it's important to recognise that these things do happen. Drives can also fail subtly, leading to silent data corruption, and RAID doesn't protect against this kind of thing. Hearing that news, you might be tempted to set up LVM, to conjoin your drives into a single logical volume. This has the disadvantage that, if one drive breaks, the whole volume becomes unreadable. Such practice is called *hating your data*. Don't hate your data. Have a backup strategy in place. Much of the data you may plan on storing is likely to be pretty fungible anyway: Linux ISOs and Steam libraries can be redownloaded, DVDs and CDs you've ripped can simply be ripped again, and so forth.

RAID 6



Wikipedia will tell you all about the more exotic RAID levels, but you need more than two hard drives for them to be of any use.

and for this purpose, we'll use `gdisk` (strictly necessary for drives larger than 2TB). SSH into your server (as root if you set a password earlier), and run:

```
# apt-get install gdisk
# gdisk /dev/sdb
```

Enter `p` to list any extant partitions. You'll want to delete these by pressing `d` and following commands until there's none left. Now create a new partition by pressing `n`, and accept the default of 1 for its number. Also accept the default start sector by pressing Enter. We could just use all of the drive, using the last sector to mark the end of the partition, but this is potentially risky: There are often discrepancies of a few megabytes between drives of ostensibly the same capacity (even ones with identical model numbers). This won't be a problem right away, since `mdadm` uses the size of the smallest drive, but we may have to replace one in the future, and it would be annoying if this replacement came up a little short.

In this case, we might enter `-1G` for the last sector, sacrificing 1GB. This is probably overly cautious, but it's only about 0.1% of the total capacity, and could save much hassle later. Use a similar ratio if your drives are differently sized, and use trial and error if your maths is shaky — do-overs are allowed if you mess up. Enter `FDD` when prompted for the partition type, and then press `p` to make sure things look okay. If they do,

press `w` to write the table to the disk. Now quit `gdisk` and repeat the process for `/dev/sdc`.

We also need to install and configure `mdadm`. Installation is simply `# apt-get install mdadm`, which asks whether you need any `mdadm` devices to be available at boot time. We don't, so just enter `none`. As a final step, we wipe the drives' superblocks, in case data from any previous RAID arrays is still there:

```
# mdadm --zero-superblock /dev/sdb /dev/sdc
```

With the drives now primed, we can create our mirrored array:

```
# mdadm --create /dev/md0
--level=1 --raid-devices=2 /dev/sdb1 /dev/sdc1
```

This asks you about metadata at the beginning of the drive — don't worry, it's safe to enter `y`. Then it creates a new device node, and at this stage, it would be rude not to put a filesystem on it: `# mkfs.ext4 /dev/md0`.

We need to create a mountpoint for our RAID device, which is just a matter of `# mkdir /mnt/mpcraid`. Finally, we need to ensure our array is automounted at boot. We could get away with referencing the array by its device node (`/dev/md0`), but it's more failsafe to use its UUID, which we ascertain with `# blkid`. Armed with this knowledge, add a line of this form to `/etc/fstab`, and all should be sweet:

```
UUID="90abcdef-..." /mnt/mpcraid ext4 defaults 0 0
```


Establishing a static IP

Stop your server being — to adopt the haughty parlance of the authorities — of no fixed abode.

By default, Debian requests an IP address from your router using DHCP. This means, though, that on the next reboot, it may well end up with a different IP, which will make SSHing in from elsewhere on the network a challenge, and also flummox any port forwarding arrangements later.

Some broadband routers enable you to reserve an IP for a machine based on its MAC address, which is one way of solving this problem, but we can also just set up a static IP on our server. We need an address that is of the same shape (by that, we mean belonging to the same /24 subnet) as that of your router — the IP address it has already assigned you is a perfectly good choice. You can find this out by running this command: `# ip a`. This shows you all kinds of useful information about your network interfaces, of which there are probably at least two: the loopback interface `lo`, and your Ethernet card `eth0`. Look for a line such as:

```
inet 192.168.1.100/24 brd 192.168.1.255 scope global eth0
```

...in the `eth0` stanza. The `192.168.1.100` part is your machine's IPv4 address (we're not going to concern ourselves with IPv6 addresses today) on your home network. Yours will be different (it might not even begin with 192.168), so don't just copy this blindly. In this case, the router's address will also commence 192.168.1. You can find the last part either by already knowing it, by looking in the router's small print, or by running the command:

```
# netstat -nr
```

...and glancing at the `Gateway` column (it's usually 1 or 254). As well as assigning IPs, DHCP also provides routing and DNS information, so since we're eschewing DHCP, we need to explicitly tell our machine about our network. In Debian, this is all done in a file, which the following commands back up and open:

```
# cp /etc/network/
interfaces{,.bak}
# nano /etc/network/
interfaces
```

Replace the line:

```
iface eth0 inet dhcp
```

...with the following block (leaving intact any preceding lines, such as `allow-hotplug eth0`):

```
iface eth0 inet static
address 192.168.1.100
```

```
jonni@ruffidready ~$ ssh 192.168.1.100
The authenticity of host '192.168.1.100 (192.168.1.100)' can't be established.
ECDSA key fingerprint is SHA256:DyeADoivUfOpBkd36cm36tSfSIHrqKXorL44+tUBAc.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.100' (ECDSA) to the list of known hosts.
jonni@192.168.1.100's password:
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Jun 15 07:36:39 2016 from 192.168.1.144
jonni@lxfserver:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group
    link/ether 08:00:27:62:db:d8 brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.100/24 brd 192.168.1.255 scope global eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fe62:dbd8/64 scope link
        valid_lft forever preferred_lft forever
jonni@lxfserver:~$
jonni@lxfserver:~$
jonni@lxfserver:~$
```

The first time you SSH into a machine, you need to confirm the machine's fingerprint. The "ip" command displays a lot of information for few keystrokes.

```
netmask 255.255.255.0
gateway 192.168.1.254
```

where the gateway address is that of your router. Save this file, and exit with `Ctrl-X, Y, Enter`. We also need to tell Debian to use the router for hostname lookups, which involves another file:

```
# nano /etc/resolv.conf
```

This time, delete any lines beginning with `nameserver`, and leave in their place the line:

```
nameserver 192.168.1.254
```

Again, the IP here is that of your router (which will forward DNS queries to your ISP). You may also prefer to use Google's DNS servers (8.8.4.4 and 8.8.8.8; multiple `nameserver` lines are allowed). Either way, save, exit, then restart the network with:

```
# systemctl restart
networking
```

Now check you still have connectivity with:

```
# ping -c5 google.com
```

If you see the following:

```
ping: unknown host google.com
```

...then something isn't right with your `nameserver` settings. If you see a different error message, then your `interfaces` file needs some tweaking. Try reverting the settings — aren't backups great for this kind of

thing? Your router might need a different netmask.

The first thing we want to set up is SSH, so that we can log in to our server remotely. Install it with `apt-get install openssh-server`, which also starts the server. You can try logging in by running `ssh 192.168.1.100` on a different Linux machine, or using PuTTY in Windows. It's a good idea to reboot your server at this point, to check that the network settings survive a reboot, and our SSH server starts. With SSH now working, your keyboard, mouse and monitor may be summarily dismissed (which might improve local feng shui), and we can continue setting things up from the comfort of another machine (if you want).



Getting remote access

Control your server by dynamic DNS and forwarding ports.

Being able to access your server from anywhere in the world can be very handy, but running internet-facing services carries risks. If we allow outside access to the SSH service, then we really should have strong passwords or (better) use keys.

It's reasonable to disable access to the root account (if you set a password for it during the install; otherwise, it's already disabled), and logging in as a lowly user, using `sudo` for privileged operations. This is controlled with the `PermitRootLogin` setting in `/etc/ssh/sshd_config`, which you can set to

No or, if you want to allow root to log in using a key, `prohibit-password` (the default on Debian). It's probably a good idea to check that SSH is working first, though, so try to log in from another machine:

```
# ssh user@192.168.1.100
```

...where `user` is your username on the server (we'll use this username/IP address combination throughout). If that works, log out and we'll generate our key (it doesn't have to be done on the server). If it doesn't work, check the logs on the server for errors with `journalctl _COMM=sshd`. To generate a 2,048-bit RSA key pair, run the command `ssh-keygen` while logged in to another machine as your user — we'll copy it to the server after. Accept the default location, and choose a password for your key. This adds an extra layer of security in the event the key is stolen.

SSH key logins work by having a public key (it doesn't matter if anyone sees it) on the server, and a private key that is safely guarded by the user. Both keys are used during the login process

to authenticate the user by some mathematical sorcery. This means that forcing key-based login entails carrying your private key around with you wherever you go. Different people will tell you different things about what is the best way to do this.

Basically, if you choose to keep it on a USB stick, make sure you don't go leaving that stick on the train/bus/horse-drawn carriage.

Running `ssh-copy-id user@192.168.1.100` adds our public key from the default location (`~/.ssh/id_rsa.pub`) to the file `/home/user/.ssh/authorized_keys` on the server. This can be done manually, too, but why waste keystrokes? We can test it works like so:

```
# ssh user@192.168.1.100
```

All going well, we should not be asked for a password. If you want to disable password logins entirely, you can add the directive

`PasswordAuthentication no` to `/etc/ssh/sshd_config`. But doing so means that if you don't have access to your private key (in the file `~/.ssh/id_rsa`), there is no access for you. If you do copy your private key, ensure that it is only readable by your user (i.e. it has file permissions 600), otherwise SSH shouts at you for being insecure. Since filesystems commonly used on USB sticks (FAT32 and NTFS) don't support Linux permissions, you need to copy the key off such media (and then run `chmod 600 id_rsa`) before attempting to log in. The private key can be copied to the `.ssh` directory on the machine you're working on, in which case it is picked up automatically, but it can also be

renamed, or stored elsewhere — in which case, you need to use `ssh -i /path/to/key`.

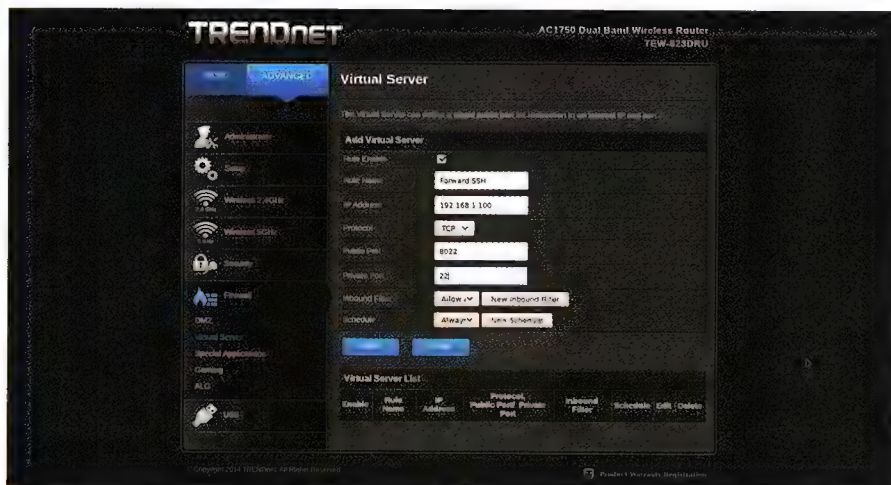
There's one final step to make remote access work, and that's to tell your router to forward SSH traffic from the WAN to your home router. Our server listens on the default port (22), but we can have it listen on a different port, which at least prevents our server being found by robotic port scans. How to configure this varies from router to router, but the goal is to forward external traffic from an obscure TCP port (8022, for example) to our TCP port 22 on our server, 192.168.1.100.

Dynamic DNS and SSH trickery

Having remote access to our server this way is only useful if we know our router's external IP address, and most users obtain said address dynamically from their ISP, so it changes often. The solution is to use a dynamic DNS service provider (www.duckdns.org is free) to provide a hostname, and update its DNS records on request from your server. Depending on the provider, we can automate this by running a cron job once a day on our server. As well as using SSH to remotely administer our server, we can use it to send and receive files via SFTP. Most file managers allow you to navigate to `sftp://mpcraid.duckdns.org:8022`, for example, and log in with your user's credentials, but it's not a very efficient way to transfer large files. It would be better to set up a web-based system, using OwnCloud (<https://owncloud.org>), for example. Rather than exposing multiple services via port forwarding, consider tunneling them over SSH. For instance, if you have a web server on your LAN, access it with:

```
# ssh user@mpcraid.duckdns.org -p 8022 -L8080:localhost:80
```

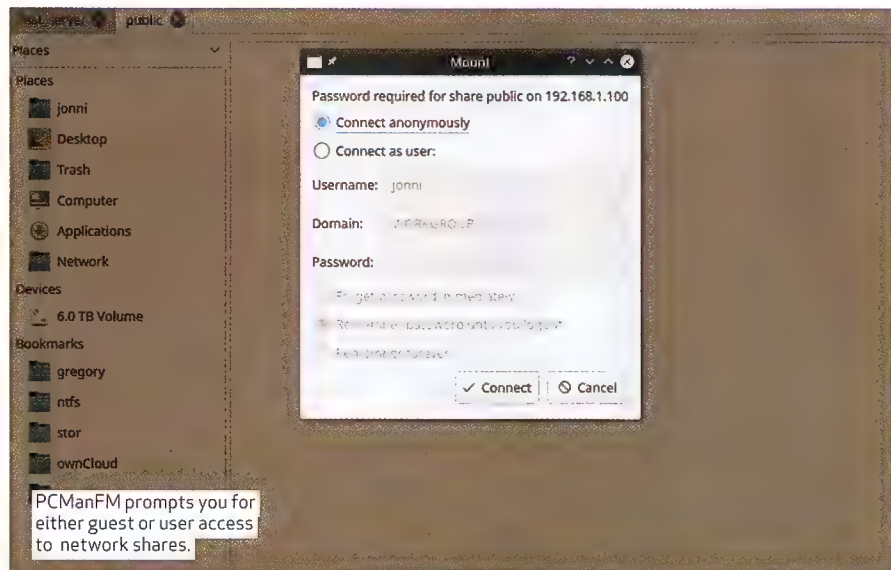
Now open a browser and point it at `http://localhost:8080` — traffic has been forwarded through the tunnel. Pro tip: You can add tunnels to an existing SSH session by pressing Enter, `~`, `c` and entering `L8080:...` etc. at the prompt.



This is what port forwarding looks like on a budget Trendnet router. It will be different on other hardware, but the basic idea is the same.

Adding Samba

Get ready to dance to the sharing protocol with extra bossa nova.



One of the most noble duties any home server can perform is sharing files. Whether it's to store the gigabytes of bangin' psytrance tunes you've amassed, or just a place to put things when you can't find a USB stick to throw at your cohabiters, having some central and communal storage space is incredibly useful. Unix-like OSes have their own file sharing protocol called NFS, which has been around since the 1980s.

This is certainly an option, but not one we'll indulge today. Instead, we'll use Samba, which is an implementation of the sharing protocols used in Windows. This has the advantage that our server will be accessible to any Windows machine or Mac, as well as any iOS or Android devices.

Before we set up Samba, it's a good idea to set up some directories for the network shares first. We'll store them on our RAID, which should be auto-mounted if you've rebooted since setting it up. If not, mount it now with

```
# mount /mnt/mpcraid .
```

Let's make those directories:

```
# mkdir /mnt/mpcraid/{music,public,docs}
```

We're going to allow anyone read access to all of these, and we'll also enable anyone to write to the public directory. If you have some music or documents that you feel other network users would benefit from, then now is a good time to populate those directories. Samba shares can be set up with user and password access, but for a home network, it's simpler to allow guest access to your shares.

This means we'll have to make the public directory world writeable with:

```
# chmod 777 /mnt/mpcraid/public .
```

Now we'll `# apt-get install samba` and set up our shares. Edit the `/etc/samba/smb.conf` file, and add the following lines in the Share Definitions section:

```
[public]
    path = /mnt/mpcraid/
public
    read only = No
    browsable = Yes
    guest ok = Yes
```

Now restart the service with:

```
# systemctl restart smbd .
```

You should be able to browse the server by navigating to `smb://192.168.1.100` from any file manager (this syntax also works on Mac; for Windows, use `\\192.168.1.100`). From Linux machines, you can mount the share via the command line (so long as the `cifs-utils` package is installed):

```
# mount -t cifs
//192.168.1.100/public /mnt/
smbpublic/ -o user=guest
```

Make entries in `/etc/samba/smb.conf` for the music and docs shares, as we did with public. This time, omit the `guest ok` line, and set `read only` to `Yes` (although it doesn't really matter, since those directories, for want of better phrasing, aren't writable by `nobody`).

Any files deposited will be owned by the `nobody` user, which is where Debian maps Samba's guest user to. Windows 10 is morally opposed to accessing guest shares; the procedure

Printing

The SMB protocol (and the newer, printer-specific IPP protocol) allows us to share printers. Once the printer and the server are friends, anyone on the network can use the printer without having to fight with 'printer not found' errors. But first, you have to get computer and device to parley, using the Common Unix Print System (CUPS), which we requested at installation. Some printer manufacturers offer Linux drivers, but in general, these are built for obscure or outdated distros, and their use leads only to tears. Instead, have a look at the hardware that's supported by the free drivers at <http://openprinting.org/printers> — chances are your printing press is there. Many of the free drivers are installed alongside CUPS, so you might not even have to do anything here. Point a browser at <http://192.168.1.100:631>, then log in as root to access the CUPS web interface. Go to the Administration tab and select 'Add Printer'. Once auto-detected, you can click 'Continue'. On the next screen, there's a handy checkbox for sharing the printer. On the next and final screen, you can choose the precise driver to use, or upload your own PPD file. Your printer is now available to Windows and Linux machines using the IPP address http://192.168.1.100:631/printers/<printer_name>.

to persuade it to be otherwise is explained at <https://techjourney.net/cannot-connect-to-cifs-smb-samba-network-shares-shared-folders-in-windows-10>. User-level security (of which Windows 10 approves) is reasonably easy to set up, too, which enables private network shares to be set up. The Samba credentials can be synchronised with user accounts on the server, so this way you can (as described in `smb.conf`) privately share your home directory over the network.

If you run into problems configuring Samba (and you wouldn't be the first), the `testparm` program can often provide a useful diagnosis. SMB failure messages are not known for their usefulness.

Emby and Webmin

Stream media and administer your server from your web browser.

A media player, such as VLC or mpv, will happily open a file on your server remotely. But try skipping back and forth, and you'll discover that SMB is not a particularly good way to stream media. Especially if you envisage streaming to multiple users. Emby, on the other hand, is a media server that can serve content from your server or DLNA (the most horrible acronym ever created: Digital Living Network Alliance) devices.

Emby delivers streams via HTML5, and it can dynamically compress them according to the current network conditions. Note, however, that this can use a lot of CPU power, so serving a few users simultaneously might result in jittery (or outright stalled) playback. Emby can use GPU acceleration for this purpose, though, provided the appropriate drivers are installed — it currently supports Nvidia NVENC (on high-end desktop graphics cards) and Intel QuickSync (found on most recent CPUs) as an experimental feature. Besides web browsers, your content can also be streamed via apps available for Chromecast, Roku, iOS, and Android. To install Emby, we need to add the appropriate key and repository to APT:

```
# wget -qO - http://
download.opensuse.org/
repositories/home:emby/
Debian_8.0/Release.key | sudo
apt-key add -
# sudo sh -c "echo 'deb
http://download.opensuse.org/
repositories/home:emby/
Debian_8.0/ ' >> /etc/apt/
sources.list.d/emby-server.
list"
```

Then we can update our package lists and install:

```
# sudo apt-get update
# sudo apt-get install emby-
server
```

Emby is built with Mono, and has many dependencies, but APT should take it all within its stride. Once it's done, start the service with:

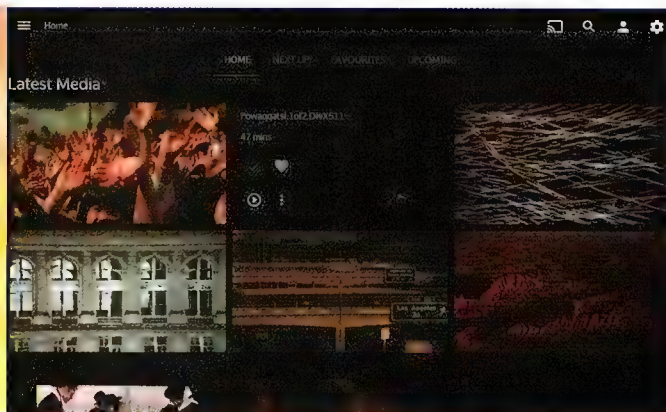
```
# sudo systemctl start
emby-server
```

And if you want it to start on every boot:

```
# sudo systemctl enable
emby-server
```

Navigating to <http://192.168.1.100:8096> ought to bring up the setup wizard, which will guide you through basic configuration. You'll want to add your music directory from the Samba section, and ideally have any videos

Emby lets us watch the classic 'Qatsi' documentaries — moving portrayals of the exigencies of a globalized society, featuring a soundtrack by Philip Glass.



you want to serve filed in a reasonably systematic manner, although Emby is pretty good at sorting things out for you. If you have a USB or PCI TV tuner installed, then Emby can use that to stream live TV to your devices, as well as record it for later viewing. You can

optionally set up an Emby Connect account, which makes it easy to access your Emby instance remotely, although this can also be done the traditional way, with the port forwarding and so forth.

Control it with Webmin

Besides frittering away hours watching media from the browser, we can also enact some serious system administration. Webmin is a web interface written in Perl that can administer all possible facets of your server. Opinions differ here, and all of this is possible through SSH, of course, but some people prefer not to have to remember the syntax of a hundred disparate config files. With Webmin, these things are all controllable through a single, graphical point of contact.

As with Emby, we add keys and repos to ensure the software stays up to date:

```
# wget -qO - http://www.webmin.com/
jcameron-key.asc |
sudo apt-key add -
# sudo sh -c "echo 'deb http://download
.webmin.com/
download/repository sarge contrib' >> /etc/apt/sources.
list.d/webmin-server.list"
```

Then it's just a case of:

```
# sudo apt-get install webmin
sudo systemctl start webmin
```

The default configuration starts a web server in SSL mode, which means that when you go and visit the URL <https://192.168.1.100:10000>, you see a scary-looking SSL error, because it's impossible to get a valid certificate for private IP space. It's safe to add an exception here — we're only accessing it through our LAN, and it's advisable to keep it that way. With that out of the way, we can log in as our user, and be able to carry out all manner of useful tasks. For example, we can configure our Samba shares (from the Servers menu), view log files, update packages, view resource usage, pretty much anything you can imagine.

Having this much power (Webmin has root) in one place is a terrifying security prospect if that one place is facing the Internet. As such, we really don't recommend forwarding external traffic to Webmin without taking additional precautions. It's entirely possible to tunnel traffic via SSH, though, as mentioned in the dynamic DNS section earlier. Webmin enables you to use two-factor authentication via a number of providers, so that remote access can be done a little more prudently.

The Linux Raid section is particularly relevant for this guide. We can examine the health of our array or take it offline for maintenance. If you set up Webmin soon after you created your array, you'll be able to see that it's still resynching — the process takes ages, even though it's effectively just synching a whole bunch of zeroes at this point. This information is also available in the `/proc/mdstat` file.

Expand and extend

With the foundations now laid, our server project can be tailored to just about any purpose you require.

We've done most of the groundwork required for any server, but we haven't really considered security, and it's worth saying a few words about this. Having only SSH visible to the outside world is a good start, especially if only key-based access is possible. If the key is stolen, though, or the password is guessed (if you were lazy and allowed password access), your whole machine is vulnerable, because that user has sudo rights. Some people only allow non-sudo users to log in, but this then precludes being able to do grown-up tasks. Trade-offs between security and convenience are commonplace. Having our services only visible to the LAN relies on the fact that our network hasn't been compromised. Certainly, as long as our home network is IPv4-based, our server is shielded from direct outside access. But what if our router or another machine on our network is infected, punching a hole through that convenience?

Putting behind us the gloomy and thorny issue of security, let's consider what to do next. Ultimately, you're only limited by your imagination. For a start, if you have a spare pair of

speakers (or if your server's in the living room, hook it up to your amp), look into setting up mpd. It's a lightweight Music Player Daemon that can be controlled via a web interface, client programs, or apps on mobile devices. Some client programs enable you to connect your listening with social services, such as Spotify and Last.fm; some (such as the glorious ncmpcpp) can be run entirely from the command line. If you really want, you could then connect your server to your television, but to make the most of this arrangement would require installing a GUI on the server. And that wasn't a road that we wanted to venture down for this guide.

When connecting to the internet from public Wi-Fi, it's wise to use a VPN to protect your traffic. There are commercial offerings here, but why not set up your own OpenVPN server? Again, tunnelling it via SSH might be the best option, or at least changing the default port. It's easy enough to set up, but you need to understand a little bit about how certificates, TLS, and things work. Armed with that knowledge, you can secure all traffic between the

questionable hotspot and your server, and if you trust your ISP (or at least are browsing via HTTPS), you have a lot less to worry about. In the interests of energy conservation, it's a good idea to put your server to sleep overnight if no one's going to need it. This requires recent hardware, but no additional software — the machine commences Zs as soon as you tell it `# sudo systemctl suspend`. Apropos to this, one can also configure Wake on Lan (WoL) so it can be woken up again from anywhere on the network. The ethtool program needs to be installed on the server, and the wol package on any machine from which you want to rouse it.

Finally, we should discuss some options to minimise the damage in case your server is struck by lightning or overzealous use of the `rm` command. It would probably take less than half an hour to reinstall the system — it would be quicker if we had copies of the relevant configuration files to hand. Small files like this are ideal for backing up to the cloud (so long as they don't contain passwords or other sensitive material).

"We should discuss options to minimise the damage in case your server is struck by lightning or overzealous use of the 'rm' command."

WE NEED TO TALK ABOUT BACKUP

This can be automated for services such as Dropbox, but it also isn't too much of a chore to periodically do this manually. In this guide, we could back up our Samba, fstab and APT sources lists. One method by which the backup could be done is by rsync-ing to another server via a maintained list of files to back up. Rsync is a hardcore protocol that can do deduplication, so it's good for transferring large files efficiently, provided you have somewhere suitable to transfer them to.

Sending large files to the cloud rapidly becomes time-consuming and logistically problematic. There is free storage available, but whether you can find enough of it, and whether it can be accessed without some nasty proprietary app, is a different story. If you have a fast network connection and unlimited funds, a remote rsync machine is the best option. Good practice dictates that off-site backups are good, but cloud storage is expensive, and people aren't very good at deleting things no longer required. The next best thing would be to back up the important files on your RAID to an external hard drive (or perhaps a NAS), and store this off-site. ■



Cantata is a Qt5-based client for MPD. It can deal with cover art, as well as all manner of online services.

how to

» QUICK TIPS

Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

NETWORKING

NON-HOMEGROUP FOLDER SHARING

After a recent Windows update, my laptop can no longer see my desktop, although its Wi-Fi connection is fine. Help!

Colin Travis

There are reports of Homegroup connections breaking after Windows updates – either delete and recreate the Homegroup, or switch it off completely in favour of the traditional approach by following these steps on both PCs.

1. Right-click the network icon in the Taskbar's Notification area and choose 'Open Network and Sharing Centre'. Click 'Change advanced sharing settings' and check network discovery and file and printer sharing are switched on.

2. Switch off Homegroups by selecting 'Use user accounts and passwords to connect to other computers', then scroll down to the 'All Networks' section and click the down arrow next to it in order to reveal additional options you need to tweak.

3. Switch on Public folder sharing if you'd like to share files through your computer's Public folders. Then verify 128-bit encryption is selected and set password-protected sharing depending

on who has access to your network. Click 'Save Changes'.

4. You'll need at least one shared folder on the desktop – browse to it, right-click and choose 'Share with'. If 'Stop sharing' is listed, the folder is already shared; otherwise choose 'Specific people' to set it up. Click 'Share' to complete the job.

Nick Odantzis

HARDWARE

IT'S NOT NAS GETTING OLD

I own a Seagate NAS 220, and received an email telling me that there's an impending certificate upgrade, which will result in me losing remote access to the unit. I don't understand – I bought the NAS 220 specifically for this feature. It's out of warranty now (it's about six years old), so I expect the cold shoulder from Seagate.

Besides buying a different NAS, going through the cloud (Dropbox, Google and so on), or enabling FTP on my 220, what can I do to remotely access files on my NAS?

Liviu Oncioiu

It sounds like your best bet for remote access is enabling FTP and taking advantage of the NAS 220's support for Dynamic DNS, which would let you get to the server through an easy-to-remember domain name.

Curious as to why Seagate's Global Access feature no longer works on your

NAS 220, though, we approached a company representative for more details. The response reads as follows: "The BlackArmor family of storage solutions was originally introduced in 2009. While we strive to support our products for the entirety of their useful lives, it is an unfortunate inevitability that some technology updates will outpace the hardware on which they are being deployed – especially for older devices."

"In this case, the Seagate Global Access Service, powered by TappIn, underwent a major update on October 7th that can no longer be supported by the code base on our older BlackArmor NAS storage devices. Subsequently, some BlackArmor customers will not be able to use the remote access feature."

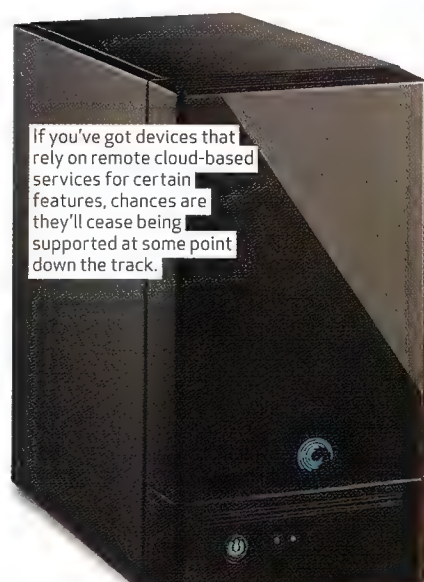
"We regret any interruption in service for our users and have reached out to those with products still under warranty to advise on how they can deal with the change in service."

APC team

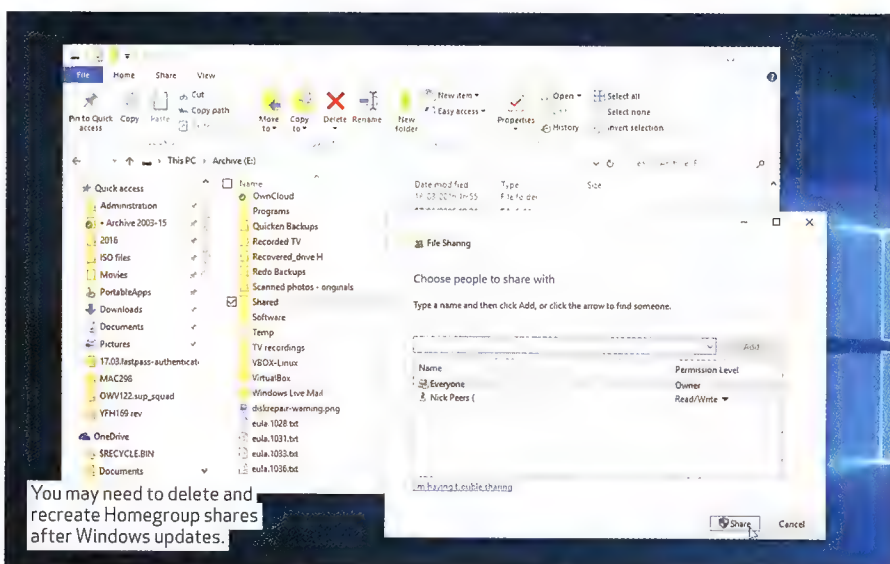
IPHONE

iOS 10 UNLOCK ANNOYANCE

I recently updated my iPhone SE to iOS 10 and, to my dismay, I now need to click my home button to unlock my phone! So before when I could just rest my finger on the button, get my fingerprint scanned and the



If you've got devices that rely on remote cloud-based services for certain features, chances are they'll cease being supported at some point down the track.



You may need to delete and recreate Homegroup shares after Windows updates.

Accessibility Home Button

CLICK SPEED

Default ✓

Slow

Slowest

Adjust the speed required to double or triple-click the Home button.

Rest Finger to Open



Open iPhone with Touch ID, without having to press the Home button.

Restoring iOS 10's original unlock settings is relatively quick and easy, once you know where to look.

phone would unlock, I now need to click the home button (or the power button) to first turn on the screen, then rest my finger on it, then click the home button again if my finger scan was successful! This seems counterintuitive. Is there a way to revert back to the old system?

Allison Bachelor

Good news — yes, there is. The function is called 'Rest Finger to Open' and it's turned off by default in iOS 10. To return to the iOS 9 way of unlocking your iPhone, head to 'Settings > General', then navigate to the Accessibility menu. Scroll down a bit and you'll see 'Home Button'. In here, you'll see 'Rest Finger to Open' is turned off. Turn this on and you should find your phone unlocks the way it used to. If 'Raise to Wake' is enabled and also 'Rest Finger to Open', this means you can unlock your phone without a single button press.

Carmel Sealey

HARDWARE

AHCI, IDE AND RAID

What's up, APC team? I'm absolutely lost. I just learned from the December issue that solid-state boot upgrades should be set to AHCI in the BIOS settings. Besides the fact that I need to use regedit in Windows 10 (already installed) to boot with the AHCI driver, I run into another problem: I already have a RAID setup across my SATA 0/1/2/3 ports. If I change them, I no longer have my RAID setup. I believe my SATA ports can only be set to IDE or Mirror SATA 0/1/2/3. Please help!



"I'm absolutely lost. I just learned from the December issue that solid-state boot upgrades should be set to AHCI in the BIOS settings."

If your Windows 10 system is already set up with RAID and booting fine, you shouldn't need to switch to AHCI mode.

My motherboard is a Gigabyte GA-990FXA-UD3.

Vincent King

The issue of switching between AHCI and IDE in Windows 10 has come up in several emails we've received. Some folks are saying the Registry Editor approach isn't working. We'll set up a couple of systems to do some testing, and then report back.

It sounds like your situation is more specific, though. AMD's SB950 south bridge supports six SATA 6Gb/s ports, so SATA3_0 through SATA3_5 are attached to the same controller. With your 'OnChip SATA Type' set to 'RAID' and 'OnChip SATA Port4/5 Type' set to 'As SATA Type', everything is using AMD's AHCI-compatible RAID driver, which is what you want. To be sure, head over to Device Manager and check under 'IDE ATA/ATAPI Controllers'.

APC team

WINDOWS

ERROR WHEN STARTING PC

My Windows PC didn't shut down properly the last time I used it, and now refuses to load. It throws up the error: 'Unknown Hard Error: \systemRoot\system32\ntdll.dll'. I'm worried as there's a lots on the drive that I need access to.

Steve Hodges

The error can be caused by all kinds of things — first we asked Steve to check the cable connecting his hard

drive to his PC motherboard. He swapped cables with his DVD drive and ensured both were seated correctly. The good news now was the PC would boot again, but then demanded a restart, after which Windows proved unresponsive at the desktop. Steve could, thankfully, reboot into Safe mode, allowing him to transfer key files to an external drive. He could also access the internet using 'Safe mode with networking', so our next step was to instruct him to try a clean boot following the procedure at support.microsoft.com/kb/929135 — sadly, we didn't hear back, so it's possible Steve decided to perform a full reinstall of Windows, which should finally resolve the problem.

Matt Hanson

HARDWARE

WE ALL SCREAM FOR WIDE SCREEN

Who chooses which resolutions make it to the standard list of screen sizes that Windows and monitors accept? Why is it 1,280 x 1,024 for instance, and not 1,200 x 1,000, or 1,500 x 1,100? Why is 1,366 x 768 still common in Windows 10 laptops? It's not a multiple of anything in either direction and 683:384 is hardly a standard aspect ratio!

Glyn Janner

Oh, come come! I think you are being disingenuous. Okay, 1,366 x 768 is actually 16:008:9, which is actually only off from the standard 16:9 widescreen resolution by less than



Most monitor resolutions do make some kind of logical sense...

0.05%. In other words, it's the closest even-numbered horizontal resolution that converts a 1,024 x 768 resolution into widescreen. Why 768 vertical pixels, you ask?

Ah, well, it's all perfectly logical. In the beginning, there was CGA resolution, which was 320 x 200. This was horrible and didn't fit properly on 4:3 aspect ratio TVs, so they doubled it horizontally and slightly more than doubled it vertically to produce VGA, which was less horrible. If you double that in both directions again, you'd get 1,280 x 960 but this requires more than 1MB of screen buffer. By the time graphics cards got good enough to do that, we were watching TV on widescreen. It's much easier to downscale 1080p HD to 1,366 x 768 because they are both 16:9 aspect ratios. And if you need 4:3 resolution, you can stick some black bars on the side and call it 1024 x 768. In fact, the odd one out here is really 1,280 x 1,024, not 1,366 x 768, as 1,280 x 1,024 (or SXGA, as it's referred to by virtually no one) is the only 5:4 aspect ratio screen

resolution, which means it doesn't display well on just about any modern screen. I think the only reason it lasted so long is that 1,024 is a round number in binary and is, therefore, easy for chip designers to address.

Luis Villazon

WINDOWS

BACK UP PROGRAM SETTINGS IN WINDOWS?

I need to reinstall Windows, but I'd like to save as much time as possible afterwards by not having to reapply program settings. Can you recommend a good tool that gives me an option to easily back up (and restore) my app settings please?

Louis Parker

Download the free CloneApp tool from www.mirinssoft.com – go to the Downloads section to download the program, which is a portable app. After unzipping the program, right-click CloneApp.exe and choose 'Run as Administrator', then browse the list to see what programs are supported – over 100 are covered, including major

apps such as Office (2010 onwards), Photoshop and so on. Tick the boxes of those programs you wish to back up, then click 'Start CloneApp'. After reinstalling Windows and your programs, launch the app again, but this time click 'Restore' to bring back your previous settings.

Graham Barlow

HARDWARE

TO SLI OR NOT TO SLI

I have a Gigabyte GA-990FXA-UD5 motherboard with an AMD FX-8320 processor, 32GB of Corsair DDR3-1600 memory, and two MSI GTX 960 OC graphics cards. My question is whether the two 960s (with 2GB of GDDR5 each) are better or worse than a single GeForce GTX 970 or 980 (or newer 1070 or 1080)? I use my PC for programs like Excel, and I like to make greeting cards. I do play hidden object games from Big Fish, but they're not very demanding. I run a DisplayPort cable to my 27-inch Asus VX279 monitor. Let me know what you think.

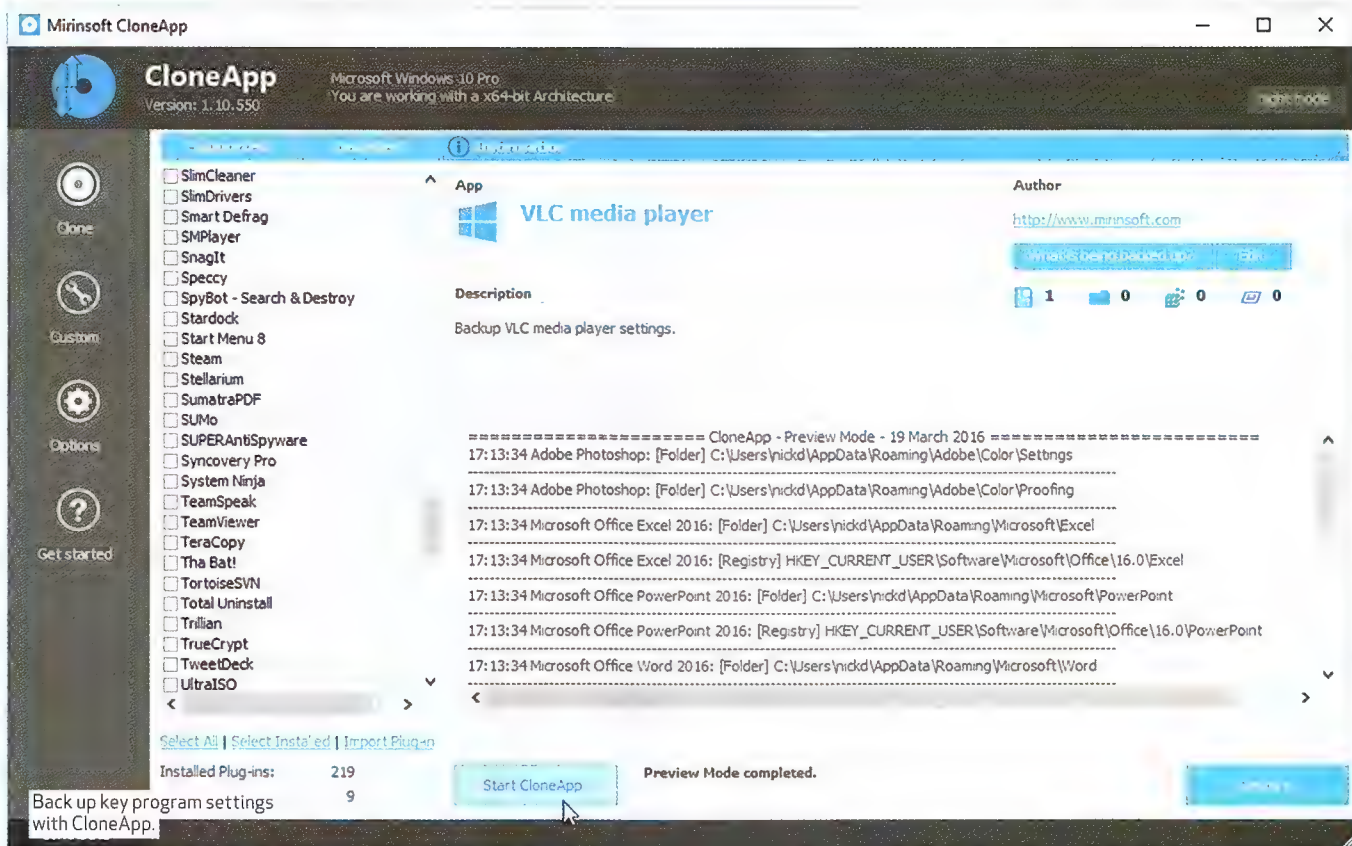
Ron V

With all due respect, Ron, you should probably take one of those GeForce GTX 960 cards out of your PC to save power. It sounds like the tasks you run mostly include productivity and casual gaming, neither of which requires a \$200 graphics card (much less two). But let's think about the question as if you were playing fast-paced shooters on a monitor with a native resolution of 1,920 x 1,080 or 2,560 x 1,440.

Combining the power of multiple GPUs through Nvidia's SLI technology (AMD's equivalent is called CrossFire) improves performance when bottlenecked by a fully-utilised GPU. But you need a demanding 3D application for that to be the case. What's more, the on-board memory of each card isn't additive – information stored on one exists on the other as well – so two 2GB cards yield an



SLI for spreadsheets and hidden object games is a bit of a waste.



effective 2GB. With that said, you can get away with 2GB of memory at 1,920 x 1,080. That's the native resolution of your ASUS VX279. Two GTX 1060s with 1024 CUDA per GPU might be a good match for the 2048-core GTX 980's performance, especially since the pair costs about \$100 less. But for someone who already owns modern mainstream cards in SLI, no way we'd would recommend a single GTX 1080 as an upgrade.

Moving to 2,560 x 1,440 really calls for a card with 4GB of memory, though. You'd definitely see a speed-up going from one 2GB board to two at QHD. Ultimately, though, they would run out of memory and limit your frame rates. APC team

HARDWARE

BEST GPU FOR 4K VIDEO PLAYBACK

I'm working on a PC for a friend. It'll be a combination 24/7 file server and Kodi streaming box, which he'll connect to a 4K TV for display output. If I'm building something to last, I want it to be completely modern and take advantage of the hardware he owns. The TV supports HDMI 2.0, so it is capable of 4K at 60Hz.

The lowest-end graphics card I can find with a matching interface is Nvidia's GeForce GTX 950. My gut tells me that it should have no problem playing back video at the same resolution and refresh rate, but I would like confirmation before telling my friend to buy it. My online searches turned up people asking similar questions.

However, the responses they received were that the 950 can't game at 4K. This machine will never be used for gaming; it just needs to stream video.

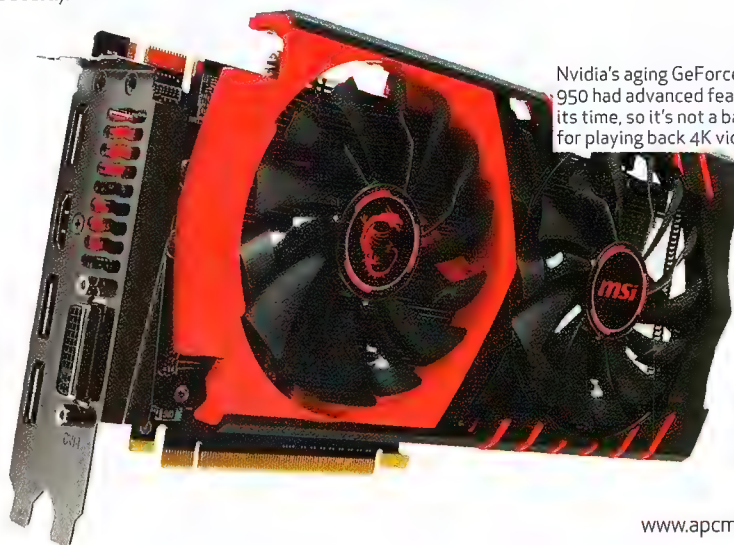
I am not really set on specs for the rest of the system, but as a general guide, it will be a Core i5 with 8 to 16GB of RAM, a 256 or 512GB SSD for the OS and apps, and four 2TB disks in RAID 10 for media files.

Tim Plett

Just to clarify, you're talking about local playback from a PC out to a television through HDMI 2.0, right? Streaming — whereby content is presented as it's being delivered — suggests that there's a network in between, adding complexity to the equation (particularly when you're talking about 4K content at 60 frames per second).

If so, then yes, a GeForce GTX 950 would suit your purpose nicely — although this will soon be superseded by the upcoming GTX 1050. That said, the GTX950 is still a good card for your needs — its GM206 GPU actually boasts more advanced decoding hardware than Nvidia's GM200 GPU, adding full acceleration for HEVC/H.265. This relatively new compression standard can be used to improve video quality at a given bit rate, or cram an existing quality level into smaller files. It's a lot more processing-intensive, though, so by offloading the task to the graphics card, your Core i5 won't have to work as hard (or use as much power).

You're right that the 950 is the cheapest discrete card with HDMI 2.0 support though. APC team



Nvidia's aging GeForce GTX 950 had advanced features for its time, so it's not a bad choice for playing back 4K video.

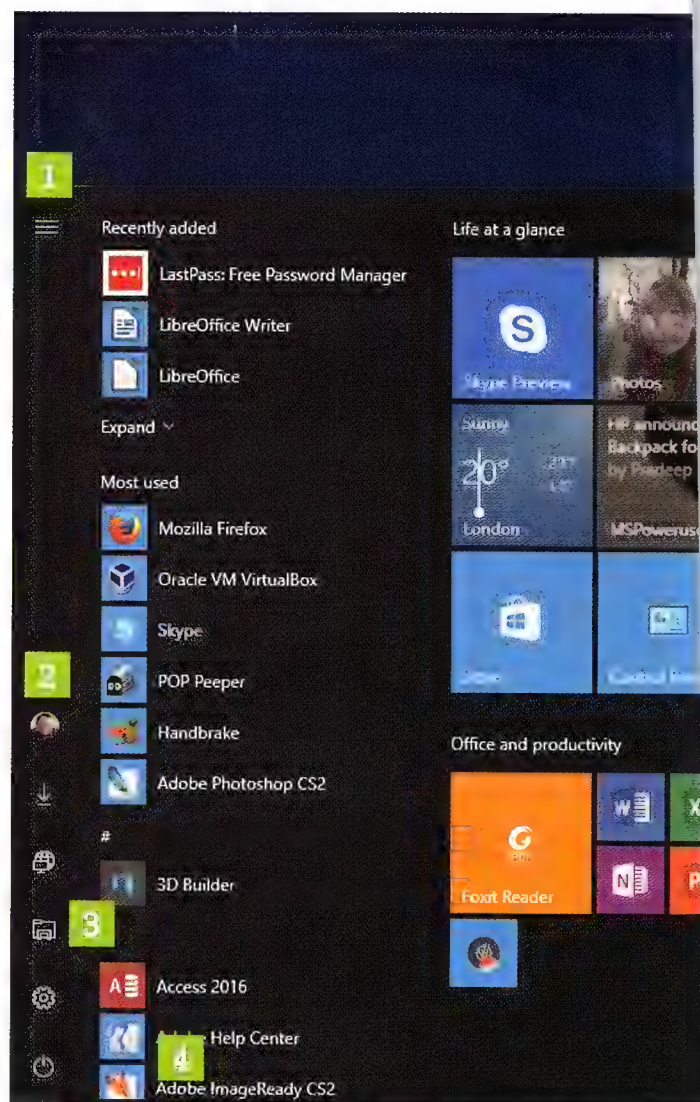
Take charge of Windows 10's upgraded Start menu

Discover how to harness the new-look Start menu and Taskbar in the Anniversary Edition with Nick Peers.

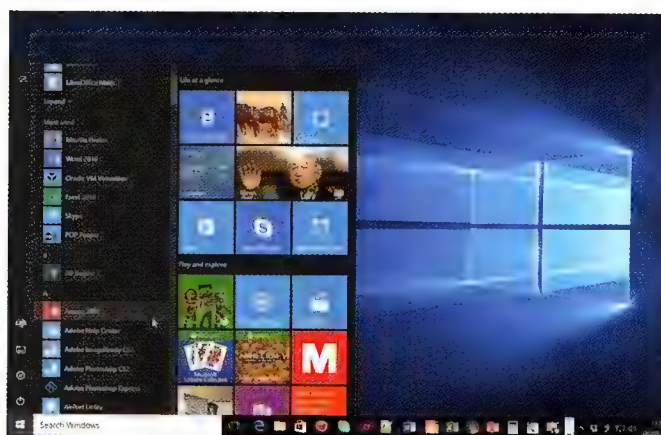
One of the headline changes in Windows 10 is that the Start menu and Taskbar have been updated. While the changes are visible – and immediately noticeable – the moment you click the Start button, they're not as radical as you might think. Behind the intuitive redesign, which makes certain popular features like the 'All apps' menu more accessible, the Start menu continues to work as it's always done since its heralded return to Windows 10.

In this tutorial, we'll examine all the major (and minor) Start menu changes, revealing how they work and where to find them, plus we'll take a look at how the Taskbar has evolved, too – in its case, the biggest change is where you now access its customisation settings. We reveal where it's gone and how to tweak it.

So let's find out what's changed...

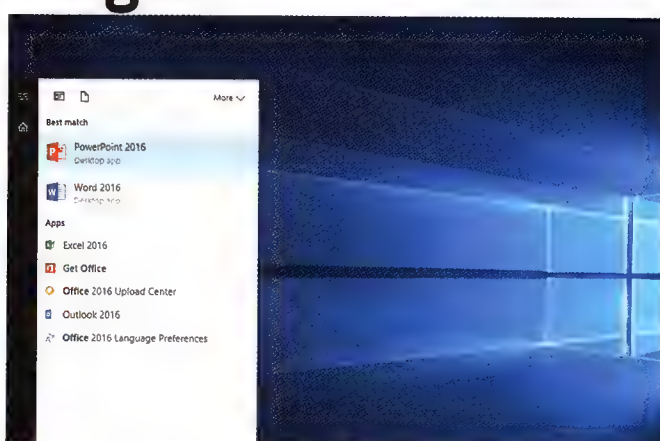


How to master the Anniversary Edition Start menu changes



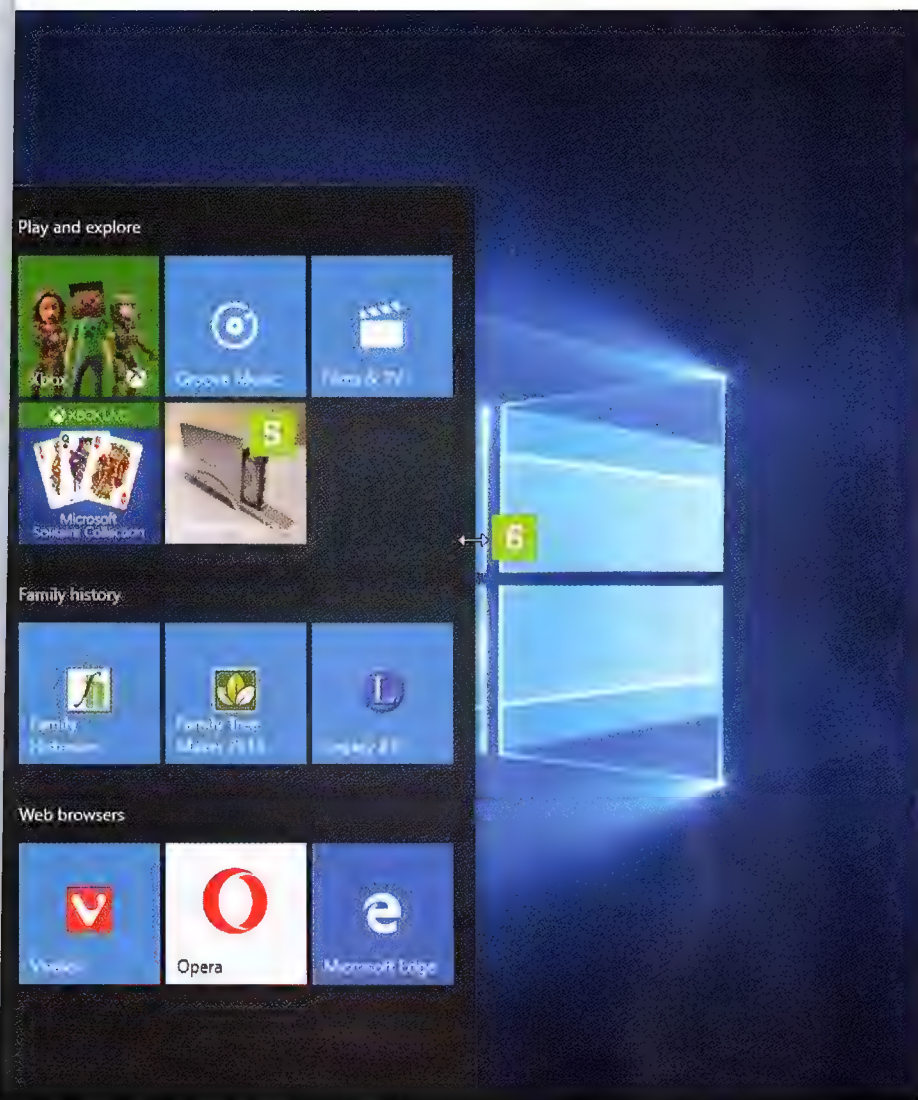
1 THE NEW START MENU

Click the Start button to view the updated Start menu. The main changes are to the left-hand portion of the menu, as our annotated screenshot reveals. Now all your installed programs and apps are no longer hidden behind the 'All apps' sub-menu, and can be found underneath the 'Recently added' and 'Most used' lists, which remain in place



2 SPEED UP APP LAUNCHES

When you click the Start button, the Cortana search box is immediately highlighted — you can then start typing the name of the program you wish to launch and it'll appear in the list, saving you the hassle of wading through the full 'All apps' list. The search is smart, too — type 'office', for example, and it'll list associated Office apps such as Word, Excel and PowerPoint.



1 HAMBURGER

Click the hamburger-like icon to show or hide the titles of the buttons in the left-hand column.

2 SIGN OUT QUICKLY

Click your user picture to access the account menu previously found at the top of the Start menu

3 OTHER SHORTCUTS

These icons give you access to File Explorer, Settings and the Power button — place user folders here, too.

4 ALL-IN-ONE

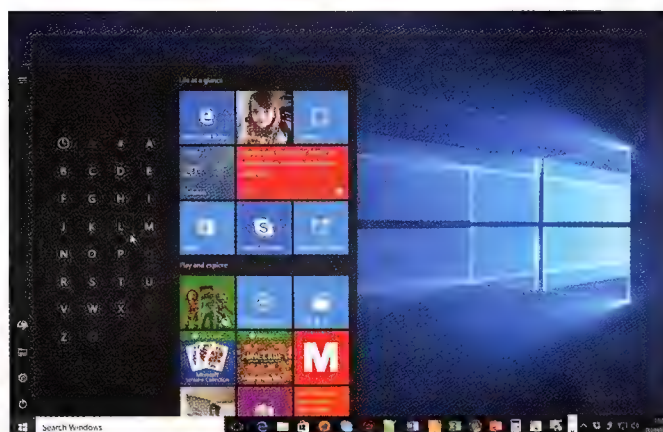
The new Start menu now lists All Apps on the main screen beneath the recently and frequently used lists

5 TILES

Your previous tiles remain untouched — but look out for an increased number of 'suggested apps' (or ads).

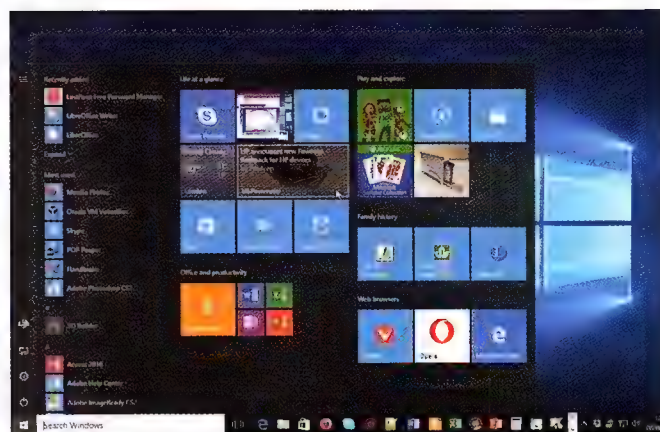
6 RESIZE

As before, adjust the number of tile columns by clicking and dragging on the right-hand edge of the menu to expand or contract.



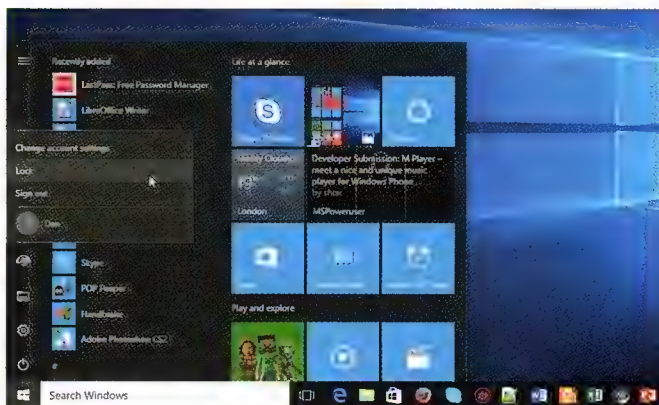
3 BROWSE 'ALL APPS' QUICKLY

Alternatively, speed up browsing by clicking the 'Recently added' header to reveal an A-to-Z list, and click a letter to jump to that letter in the apps list. You'll also see a clock icon — select this to jump back to the top of the list. Right-click an app entry to access the same options as before, including the 'Don't show in this list' option if you want to trim the apps list back.



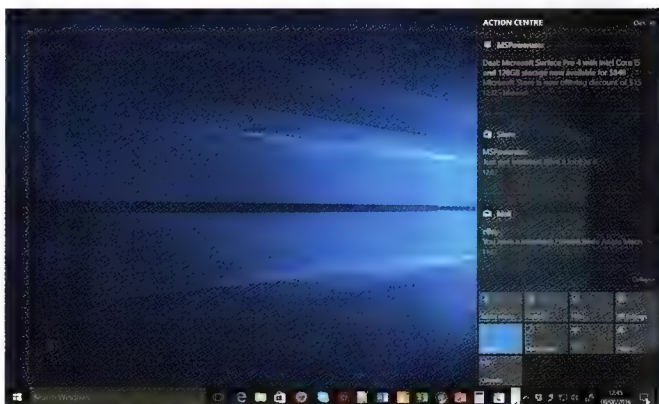
4 CHASEABLE LIVE TILES

One big change to the way Start menu tiles behave is that they can now be coded as 'chaseable' by the app developer. This means that if they're displaying live content like a news headline, then clicking the tile will take you directly to the content rather than the app's main screen. This requires app support — at time of writing, MSPoweruser is one such app.



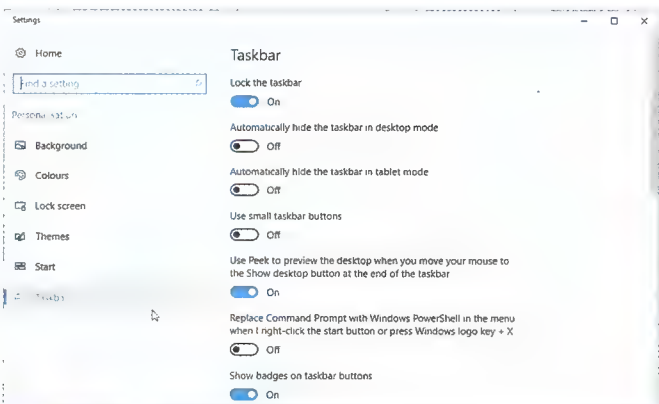
5 START MENU ICONS

The left-hand column displays four icons. Click the user photo for sign-out options, and right-click File Explorer for Quick Access shortcuts and a 'More' sub-menu with options for 'Computer Management' and 'System Properties'. Go to 'Start > Settings > Personalisation > Start' to add user folder shortcuts here to add other user folder shortcuts.



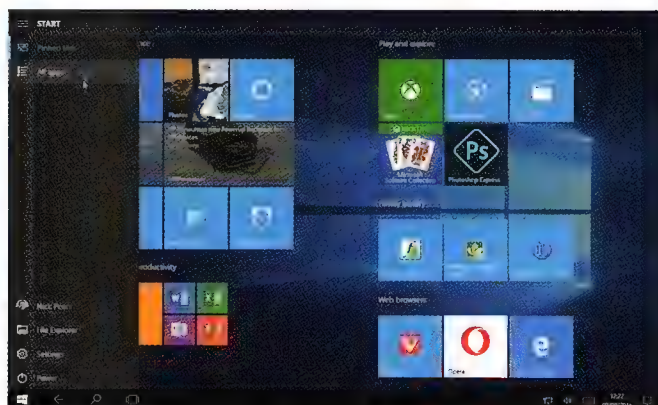
7 TASKBAR TWEAKS

The only real visible change to the Taskbar is the new Notifications button, which now sits on the far right and displays the number of unread notifications it contains. There's also a new Windows Ink option when you right-click the Taskbar. Ticking this reveals a pen-like button — click it to bring up the new Windows Ink Workspace.



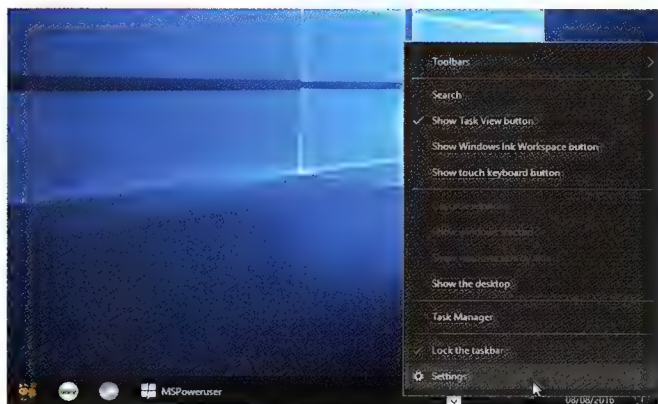
9 NEW TASKBAR SETTINGS

Previously, the Taskbar settings were split across three tabs — now they've all been merged into one section, with the options mixed up. One new setting allows you to hide the taskbar when in Tablet Mode, while there's a new 'Multiple displays' section that enables you to configure how the taskbar behaves when you've spread your display over two or more monitors.



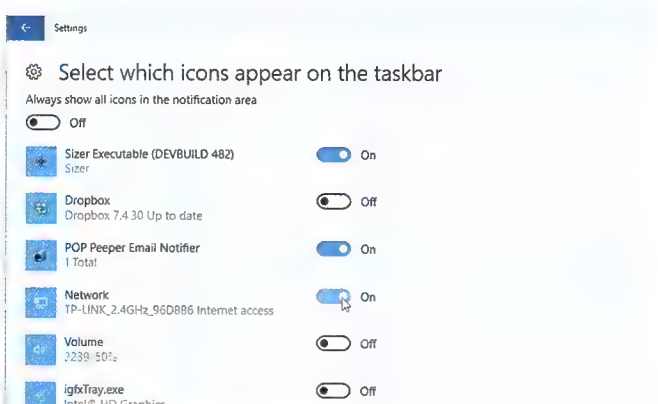
6 TABLET MODE CHANGES

The Start menu's appearance has changed in Tablet Mode too, and it now more closely resembles the old Windows 8 Metro user interface. Pinned tiles are shown by default, but you can quickly switch to 'All apps' view with one click, while once again the options on the left have been reduced to single buttons — click the 'hamburger' icon to expand them and reveal their titles.



8 TWEAK TASKBAR SETTINGS

The Anniversary Edition moves Taskbar settings from their own pop-up dialogue box to a brand-new Taskbar section inside the main Settings app, which you'll find under 'Personalisation' adjacent to the settings for tweaking the Start menu. The quickest way to access the Taskbar portion of Settings is by right-clicking the Taskbar and selecting 'Settings', which takes you directly to it.



10 CUSTOMISE THE NOTIFICATION AREA

You'll also find a shortcut to choosing how programs' Taskbar notification icons are displayed — this has been moved from its old location under 'System > Notifications & actions'. A simpler way to customise how these icons behave is to drag and drop them to and from the Taskbar (using the hidden area that appears when you click the ^ button to the left of the icons).

Conditional macros formatting

Helen Bradley explains how to apply multiple conditional formats to a single range in Excel using VBA.

When you use conditional formats to highlight information in a worksheet, you can only use one set of formats at a time. If you want your user to be able to switch between formats, you'll need to build a solution using VBA. This month, we look at a way to define multiple conditional formats for a single range of cells and apply them as and when required using worksheet buttons.

OUR CONDITIONAL FORMATS

We'll use four formats – one to identify entries that are weekend days, one that highlights higher-than-average values and one that highlights alternate rows. The final one will allow us to highlight information relating to a manager chosen from a dropdown list we've placed in cell F3. Each conditional format is based on a formula, the data range is A3:C33 and these are the formulae:

```
=WEEKDAY($A3,2)>=6
=$B3>AVERAGE($B$3:$B$33)
=mod(row(),2)=0
=$C3=$F$3
```

THE MACRO SOLUTION

In the macro solution, each format will be accessed via a CommandButton, which is added to the sheet via the Developer tab. This is the code for each of the four buttons – the code appears in the Sheet code area:

```
Private Sub CommandButton1_
Click()
Dim formatCode As Integer
formatCode = 1
applyFormat (formatCode)
End Sub
```

```
Private Sub CommandButton2_
Click()
Dim formatCode As Integer
formatCode = 2
applyFormat (formatCode)
End Sub
```

```
Private Sub CommandButton3_
Click()
Dim formatCode As Integer
formatCode = 3
applyFormat (formatCode)
End Sub
```

```
Private Sub CommandButton4_
Click()
```

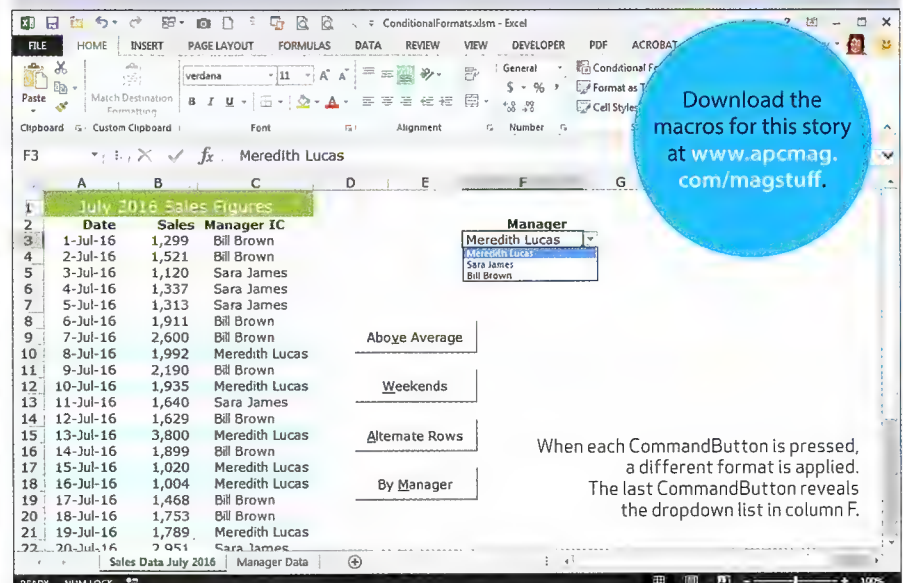
```
Dim formatCode As Integer
formatCode = 4
applyFormat (formatCode)
End Sub
```

Each button calls a routine called applyFormat which handles applying the Conditional format depending on the value of a variable, formatCode, sent to that routine. In this way, one procedure can handle all the formatting. This is the procedure applyFormat – the code appears in workbook module:

```
Sub applyFormat(code As Integer)
Dim userRange As Range,
userFormat As FormatCondition
Set userRange =
Range("=$a$3:$c$33")
Range("f:f").EntireColumn.
Hidden = True
If userRange.
FormatConditions.Count <> 0
Then
userRange.FormatConditions.
Delete
End If
Select Case code
Case Is = 1
Set userFormat =
userRange.FormatConditions.
Add(xlExpression, xlFormula,
"=$B3>AVERAGE($B$3:$B$33)")
userFormat.Interior.
ThemeColor =
xlThemeColorAccent2
```

```
Case Is = 2
Set userFormat =
userRange.FormatConditions.
Add(xlExpression, xlFormula,
"=WEEKDAY($A3,2)>=6")
userFormat.Interior.
ThemeColor = xlThemeColorAccent3
Case Is = 3
Set userFormat =
userRange.FormatConditions.
Add(xlExpression, xlFormula,
"=mod(row(),2)=0")
userFormat.Interior.
ThemeColor = xlThemeColorAccent4
Case Is = 4
Range("f:f").
EntireColumn.Hidden = False
Set userFormat =
userRange.FormatConditions.
Add(xlExpression, xlFormula,
"=$C3=$F$3")
userFormat.Interior.
ThemeColor = xlThemeColorAccent5
End Select
userFormat.Interior.
TintAndShade = 0.8
End Sub
```

The macro removes any format already in place and it hides column F. The appropriate conditional format is then added and a theme colour specified for the cells. If the fourth button is selected, column F is made visible to give the user access to the dropdown list in that column. ■





Make an iPhone-powered security cam

Give your old iPhone a new purpose in your smarthome with Manything and Nick Peers.

One key component of the smarthome is security, but it comes at a cost, particularly if you want to monitor more than one spot in your home. But why spend hundreds on cameras when you've got the hardware capabilities locked away in an old, unloved iPhone or iPad? Thanks to apps like Manything (manything.com), you can dust off your old device and turn it into a smart security camera.

You're not skimping on features either — thanks to motion-sensitive recording, alerts and the ability to view and administer your cameras remotely, Manything rivals the likes of the Canary, Arlo Q and other smart security cameras. It enables you to connect up to five mobile devices for house-wide surveillance, plus access advanced tools like operating Manything to a time- or location-based schedule by integrating it with ifttt.com.

Sadly, like most home security systems, Manything doesn't offer all of its services for free, but its prices are competitive and flexible. The Basic Free Plan includes live streaming, motion alerts and detection zones with one camera only. To record footage so you can review it, you'll need one of the paid-for plans, which requires two decisions: how many cameras you want to record (one, two or five) and how many days of footage to store in the cloud (two, seven or 30).

Manything's prices range from \$5.99 per month for two days' recording on one camera, to \$39.99 per month for 30 days of recording on up to five cameras — see bit.ly/2bmupYl to find your sweet spot. However, don't rush into a decision; when you first install the app, you get a free five-day trial of the full five-camera setup. The cheapest option is to subscribe through the website rather than the app, as the latter adds a premium depending on the package.

GET STARTED

First, verify your old iPhone is running at least iOS 6.0, which is the minimum requirement. That basically means you'll need at least an iPhone 3GS, iPad 2 or fourth-generation iPod touch to be able to use Manything. Assuming your device fits the bill, download Manything from the App Store, then open the app and tap 'Sign up' to create an account. Enter your email address and provide a strong, unique password, tap 'Sign up' again and you'll be taken to Manything's main menu.

Next, tap Camera to add the phone you're using to your Manything account, and then grant the app access to the device's camera and microphone when it prompts you for permission to use them. The main screen will appear, showing you what your phone's camera can see. You'll be prompted to press the big red button that's on the right or bottom of the screen (depending on your device's current orientation) to



Beyond security, you could record your pet's unattended antics to post on YouTube.

switch on the camera's recording capability.

After doing all of this, the app will start to record video whenever it detects motion in front of the camera. (Note that a continual recording option is also available in Manything's settings). All recordings are streamed or uploaded (in the case of time-lapse recordings) to the cloud, so make sure your device has internet access wherever you decide to place it in order for this to happen.

POSITION YOUR CAMERA

Placement of your device is, of course, crucial. First, it needs to be positioned next to a power source, so it can be permanently powered from the mains – Manything will keep your phone awake while it's running, so you can't afford to rely on battery power for long.

Second, your device will need to be on its side so its camera shoots a landscape view, as this provides a wider field of vision. Search eBay for 'wide-angle iPhone lens' to purchase a cheap lens (about \$6) to widen this further. There's a slight bowing of the picture at the top and bottom with these lenses, but it doesn't prevent you from seeing what's happening, and they should also work with iPad and iPod touch cameras too. The lens may obscure the camera's flash, which could be an issue if you want night-time security.

Third, which camera should you use? Ideally, the rear-facing camera is best, as it offers a higher resolution and provides access to the flash, which Manything will switch on after dark if noise is detected during night-time (consider switching to Still Shot mode

at night using IFTTT – read on for more details about that – as it'll produce enhanced shots in low light conditions).

Finally, how will you secure your phone in its desired position? If there's not a suitable spot to prop it up in a discreet fashion – on a bookshelf, for example – you may find that some kind of mount or clamp is required. See 'Best buys' on the next page for some suggestions. Once your iOS security camera is installed, repeat the process for any other device you plan to use to complete your security setup.



Search eBay for a range of inexpensive ways to secure your iPhone or iPad to a specific spot.

MONITOR YOUR CAMERAS

There are two ways you can keep an eye on your cameras while also administering their settings remotely. The first is through the Manything app itself – choose Viewer instead of Camera mode (tap the 'm...' button in the top-left corner of the app to switch between them) and you'll be shown a live view from each of your cameras, complete with phone status (such as

Jargon Buster

- IFTTT is a web-based service that enables smart devices and online services to work with each other using a combination of triggers and subsequent actions.
- Time-lapse recording is a technique whereby video is captured at a low frame rate. In the context of Manything, it reduces the amount of data transmitted over the internet.

Genius Tip!

- Don't be tempted by a cheap power supply for your security camera – always buy the genuine article from Apple or a reputable supplier in the interests of safety.
- Once Stills Mode is enabled, tweak it by tapping Stills Interval During Motion to set a longer interval (from five seconds up to 24 hours) between shots.

Your recordings on Manything's website

manything...

Cameras

Account

Clip chart

FAQs

Contact us

Log Out

Today, 12:34:19

Live



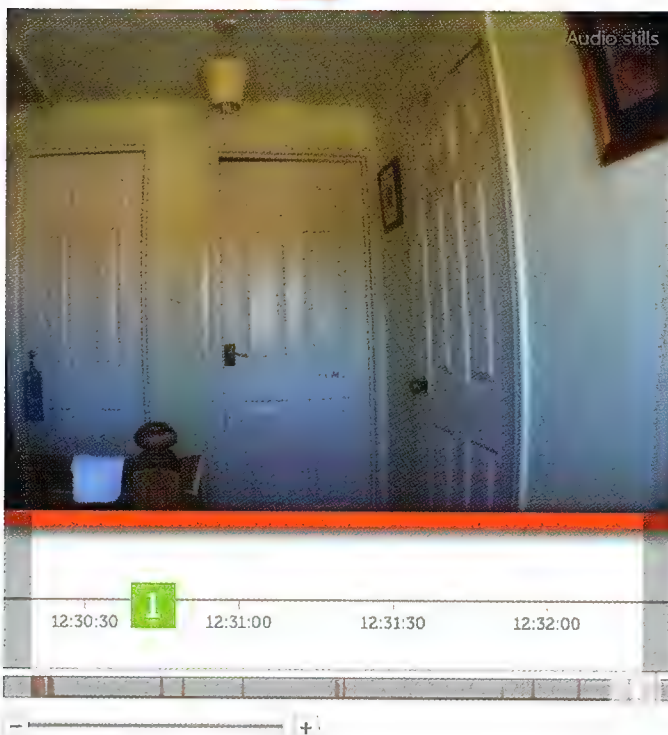
Create clips

Device: Nicholas's iPhone

100%

2

100%



Try Record on Motion - Learn more

Sessions Events Clips Timelapse Settings

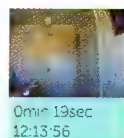
Today
12th Aug

3

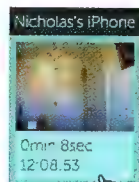
4



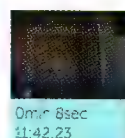
0min 11sec
12:21:39



0min 19sec
12:13:56



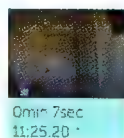
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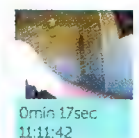
0min 6sec
11:42:23



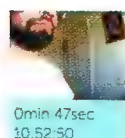
0min 29sec
11:41:04



0min 7sec
11:25:20

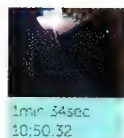


0min 17sec
11:11:42



0min 47sec
10:52:50

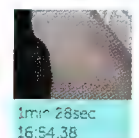
Thursday
11th Aug



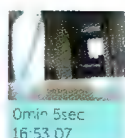
1min 54sec
10:50:32



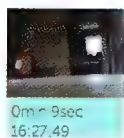
0min 20sec
10:49:54



1min 28sec
16:54:38



0min 5sec
16:53:07



0min 9sec
16:27:49



0min 15sec
16:19:47

1 RECORDINGS WINDOW

Use the timeline slider at the bottom of this pane to jump to recordings that were triggered by motion.

2 SWITCH DEVICE

Click this pop-up menu to switch to a different iPhone or iPad, if you have several set up.

3 REVIEW EVENTS

Switch to the Events tab to view all recordings that have been made, and click one to view it from start to finish.

4 REMOTE SETTINGS

Click 'Settings' here to access commonly used options, such as switching recording modes and between a device's front and rear cameras.

live or standby) and battery life, if applicable. Tap one of them to contact that camera and view its live feed, then tap Events to review a list of recordings.

You'll see a settings button next to each camera too. Tap this to tweak the adjacent camera's settings in the same way you would from the camera itself, working through the step-by-step guide on the next page.

You can also view and manage your cameras on your Mac, in a web browser with the Flash Player plug-in installed, by going to manything.com — the annotated screenshot above reveals the kinds of control you can wield from here.

ADVANCED FEATURES

The Manything app offers all the core functionality you need, but you can exercise even greater control over your cameras by connecting them to ifttt.com (IFTTT, If This Then That). Just add the Manything channel to your account on the IFTTT site and you'll find a large number of triggers, actions and recipes you can use or adapt to your own purposes.

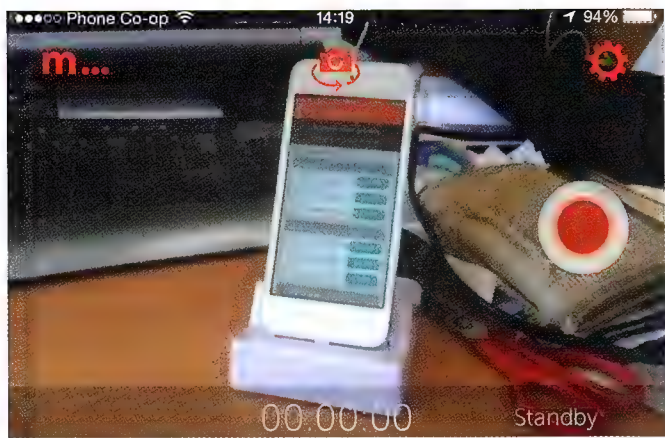
For example, you might configure certain cameras to only come on at set times of day, or have your camera's flash switch on at night when it detects sound. You can even link your cameras with other devices — for example, to get around your camera's struggle to

detect motion when it's dark by pairing it with a SmartThings motion sensor, you can use the SmartThings trigger to detect movement, then pair it with the Manything action that switches on the iOS device's flash and starts recording.

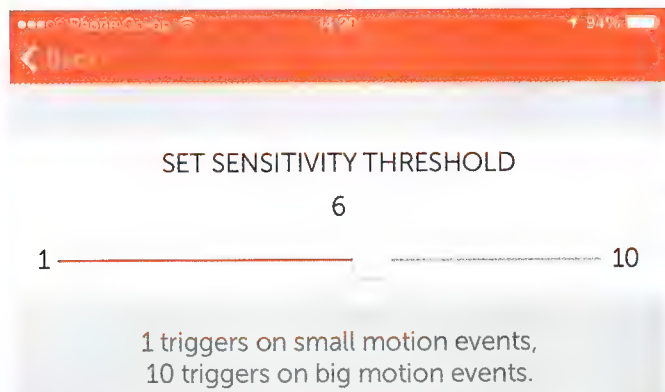
Manything scores highly on all key levels: its subscription pricing's relatively inexpensive, and it has all the features you could wish for, is beautifully designed, integrates with other smarthome devices, and lets your old mobiles live on in a relevant and helpful way, too. What's not to like?

How to

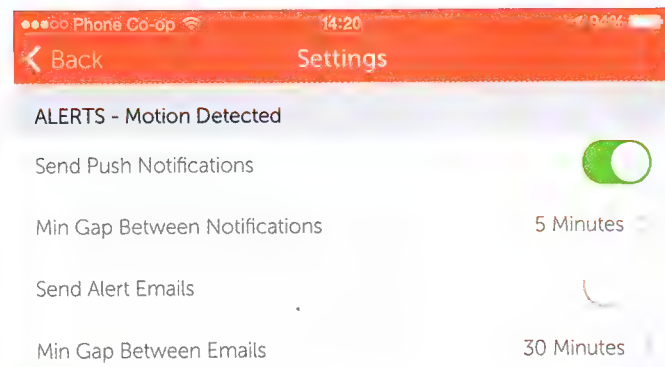
Tweak key camera settings



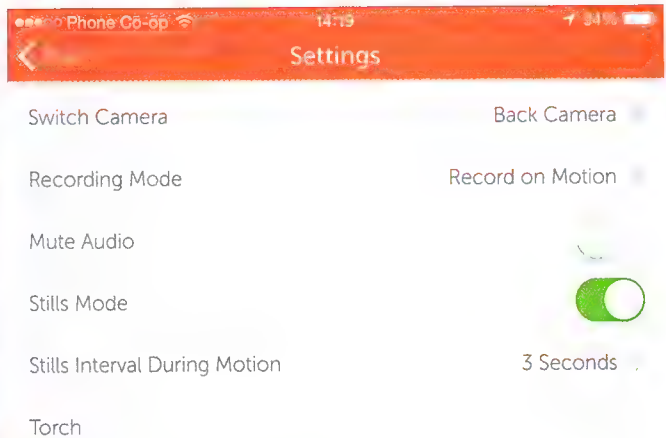
1 ACCESS MANYTHING'S SETTINGS
The majority of Manything's settings are self-explanatory for the most part. They are accessed by tapping the cog icon on the app's main camera screen. Alternatively, you can remotely tweak your camera's settings from another device that's in Viewer mode.



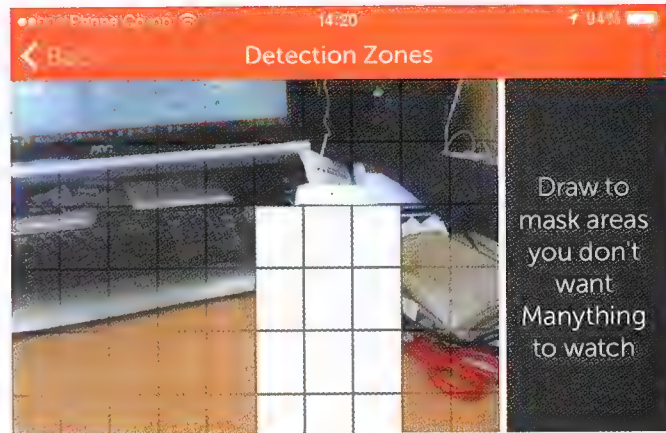
3 ADJUST SENSITIVITY SETTINGS
Tap Sensitivity Threshold under Motion Detection to fine-tune the camera's sensitivity to motion. Use the slider to adjust this setting on a scale of 1 to 10, where 1 corresponds to small motion events and 10 means large amounts of motion. The default value is 8.



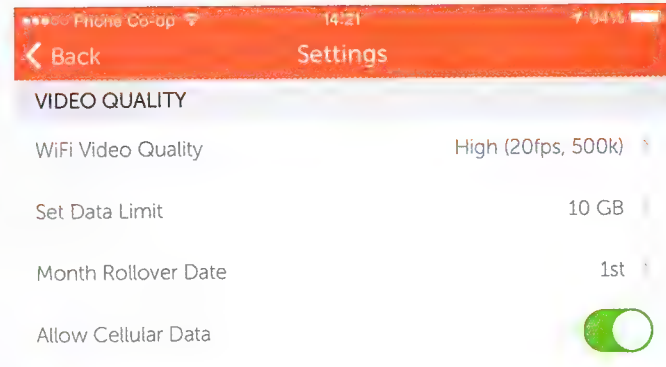
5 CONFIGURE ALERTS
You can choose to receive email alerts, push notifications, or both whenever motion is detected or the camera's status changes — adjust the appropriate switches as you want, then set minimum durations during which you don't want additional emails or notifications.



2 TURN ON STILLS MODE
Stills Mode lets you switch to time-lapse recording — a good choice if the upload speed of your internet connection is slow. Once this is switched on, still images are recorded at three-second intervals, rather than capturing a continuous video stream.



4 SET DETECTION ZONES
Tap Detection Zones to mask out part of the screen where you don't want to monitor movement. You'll see the camera view overlaid by a grid. Simply tap those squares in the grid where you want to disable Manything's motion detection, then tap Back.



6 TWEAK VIDEO QUALITY
By default, Manything picks a 'fair quality' setting for video, but you can change this up or down separately for your device's Wi-Fi and mobile data connections. Additionally, you can set monthly data limits — from 2GB to 20GB for Wi-Fi, and 100MB to 2GB for 3G — if required. ■

Power up your Mac's menu bar

Craig Grannell shows how to add loads of handy widgets to your Mac's menu bar with BitBar.

The lofty claim made by BitBar is that you can use it to put anything in the menu bar. Before your imagination runs amok, what this refers to is installing scripts that output to the menu bar. So alongside the clock and your Mac's Wi-Fi status, you can add additional widgets to track important info and quickly perform basic system tasks.

In our walkthrough, we show you how to get started with BitBar, and run through a few of the plug-ins we've found useful: an iTunes track rater, a Clipboard history, a Pomodoro timer (for tracking work/break cycles) and displays for currently playing music and currency rates. However, those are just our favourites, and we encourage you to explore BitBar's website (getbitbar.com) for other plug-ins to suit your own setup. Examples you might find useful include bandwidth testers, sports scores, an amusingly morbid 'death timer' and even a plug-in that enables you to install additional BitBar plug-ins right from the menu bar!

However, we've gone resolutely manual in this tutorial, so you can get to grips with BitBar and how it works. In part, this is because the app is very

much the brainchild of scripting people. It's therefore lacking some of the elegance usually associated with Mac utilities. A few plug-ins we tried didn't work at all. Others had strange default setups, but didn't have a settings window for changing them.

TAILORED TO FIT YOUR NEEDS

Fortunately, BitBar makes it possible to deal with such issues, if you're willing to get your hands a bit dirty. For any plug-in you find that needs a tweak, you can open its script in a plain text editor — for a couple of the examples opposite, we've used BBEdit (barebones.com), which has a free trial version that simply disables some features after 30 days.

Elsewhere, if something doesn't really work at all, just open BitBar's plug-ins folder, drag the offending item

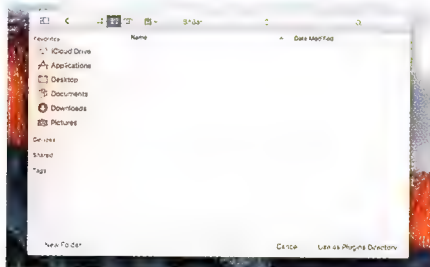
to the Trash, and refresh BitBar by selecting 'Refresh all' from the Preferences menu of any installed plug-in.

Although this is more effort than some utilities we cover, BitBar's extensibility and usefulness make it worth that little bit of extra hassle. And if you get really into BitBar and also fancy yourself a dab hand at scripting, you can always write your own plug-ins, as outlined at github.com/matryer/bitbar.

"BitBar enables you to add extra items to the menu bar to track info and perform simple tasks."

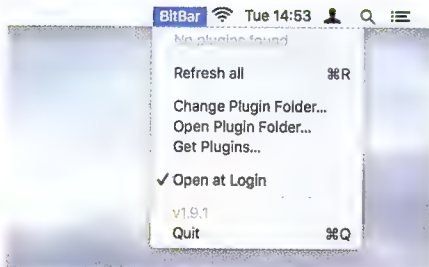
How to

Get started with BitBar



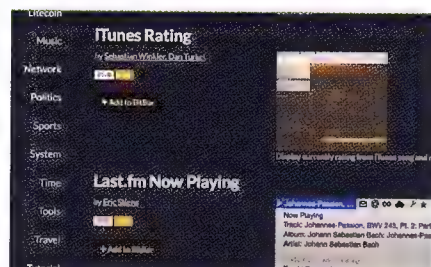
1 CREATE A FOLDER

On first starting up BitBar, it'll display a dialog box so you can decide where its plug-ins will be stored. Create a new folder in your chosen location (perhaps one called BitBar in your Documents folder) and click Use as Plugins Directory.



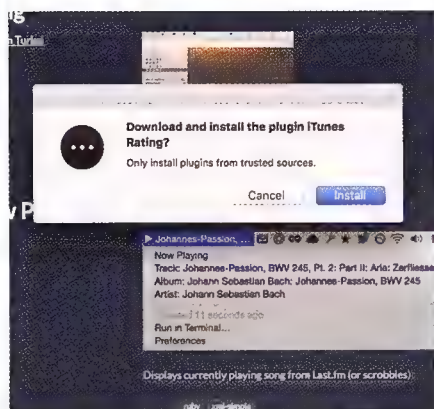
2 ACTIVATE BITBAR

You should now see BitBar in the menu bar. Right now, it doesn't do an awful lot — you can click to open its menu and change the plug-ins folder, set the app to open at login, or quit it entirely. We need to install some plug-ins!

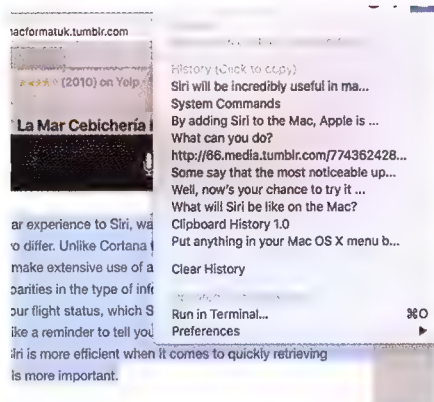


3 CHECK OUT PLUG-INS

In BitBar's menu, click 'Get Plugins'. You'll be sent back to the website you downloaded the app from. Let's start with a plug-in for quickly rating iTunes tracks. In the Music section (on the left), find iTunes Rating.



4 INSTALL THE PLUG-IN
Click 'Add to BitBar' under the plug-in and a confirmation dialog will appear. Click 'Install'. In the menu bar, the 'BitBar' text will be replaced by the plug-in's icon. If iTunes isn't open, this will be a musical note — click it and choose Launch iTunes.



7 POWER UP THE CLIPBOARD
From the System section, install Clipboard History. This places a clipboard icon in the menu bar. Click it and you can access the last ten pieces of text or links you copied. To send an item back to the Clipboard, just choose it from the menu.

```
IT I > app = vox J; then
track_query="track"
artist_query="artist"
fi

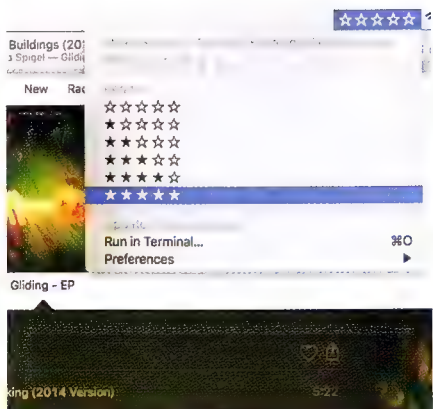
# output the track and artist
track=$(osascript -e "tell application \"\$app\"
artist=$(osascript -e "tell application \"\$app\"

echo "$artist: $track | length=40" | awk -F '
echo "----"
echo "$artist"

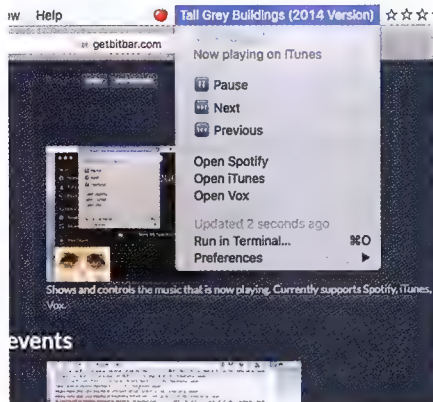
if [ "$playing" != "" ]; then
echo "Now playing on $app | color=gray ba
echo "----"
echo "⏸ Pause | bash=$0 param1=pause par
else
echo "▶ Play | bash=$0 param1=play param
fi

echo "⏮ Next | bash=$0 param1=next param2=$0
```

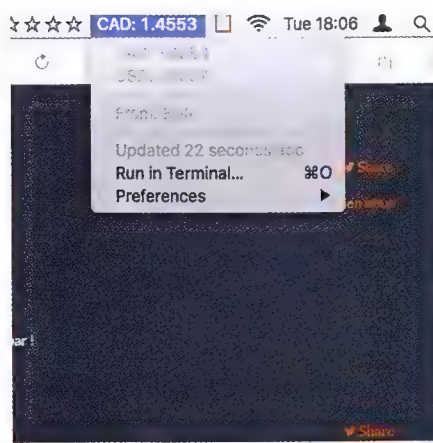
10 MAKE SOME CHANGES
After the opening quote, add "\$artist:" and save the file. You should now see the artist and track name in the menu bar, to a maximum of 40 characters as stipulated in the script — you can change that too, if you like.



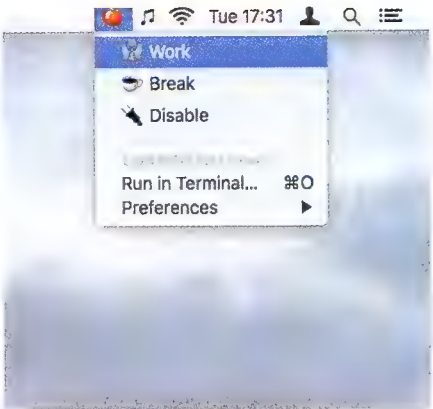
5 USE THE PLUG-IN
Prior to iTunes playing, the widget might register an error, but as soon as you play a track, the widget should show the corresponding star rating. You can update this by clicking the stars in the menu bar and choosing a new rating.



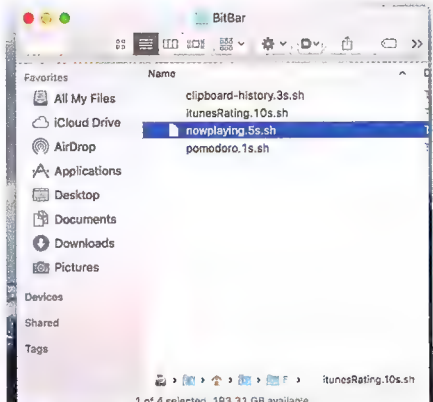
8 A 'NOW PLAYING' WIDGET
From Music, install Adam Kenyon's 'Now playing' plug-in. When music's playing, this displays the track name, making it a handy companion to the rating plug-in. Open its menu to access playback controls and artist info.



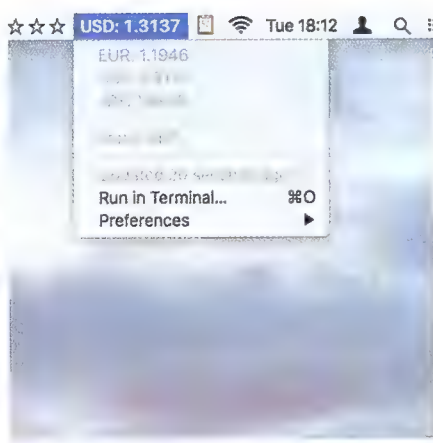
11 GET A CURRENCY TRACKER
In Finance, install Currency Tracker. By default, this cycles through how many US and Canadian dollars you get for a Euro. In BitBar's plug-ins folder, open currency-tracker.py in your text editor and find the currFrom and currTo values to alter them.



6 INSTALL A TIMER
From the Time section of BitBar's website, install the Pomodoro Timer plug-in. When activated by choosing 'Work' from its menu, it starts a 25-minute countdown that cycles with three-minute breaks to keep you focused.



9 EDIT A PLUG-IN
Open BitBar's plug-ins folder (pick 'Preferences > Open Plugin Folder' from any BitBar plug-in's menu) and then open the nowplaying.sh script in a text editor. In the output section, find the part that starts echo "\$track | length=40".



12 EDIT CURRENCY SETTINGS
To set a new base comparison currency, change currFrom's EUR to something else (say, AUD). Then update the currTo list as you like. Save, then pick 'Preferences > Refresh' all from BitBar's menu. Your new settings will be applied.

Manage storage in macOS Sierra

Alan Stonebridge discovers how the latest version of OS X macOS helps to ensure you have enough space.

One of the conveniences Apple has added in macOS Sierra is Optimized Storage, which helps you to keep plenty of space free for whatever task you take on next. The feature is tucked away in the About This Mac dialog's Storage tab, where there's a new button labelled 'Manage' next to the breakdown of how your startup disk is being used. Clicking this button opens a new storage management window (which is actually part of the System Information app, located in the Utilities folder; in it, choose 'Window > Storage Management').

Many of the things you can accomplish in this window can be done elsewhere in Sierra and its bundled apps, as long as you know where to look

and are comfortable making alterations. However, this window consolidates prime methods for saving space in one place, and provides advice on things you might have overlooked (or be unaware of) and how much space you might be able to reclaim. Even if you consider yourself to be fairly in control of your Mac, we urge you to at least open the app and check its recommendations, some of which may relate to older preferences you've already discounted, and some that are new in Sierra.

SHARED BENEFITS

Changes you make in the window (except for apps you trash) apply only to the current user account, but your choices will affect others who share

your Mac. You might save even more space by asking them to follow suit.

Beyond the 10 minutes this process will take you, you'll need to allow some extra time for your Mac to do its part – to process photos, say, which depends on other factors such as library size, whether you've already enabled iCloud Photo Library, and your upload speed.

If you turn on iCloud Drive's ability to keep only recently used files on your Mac as space gets low, files appear in Finder where you left them, but with a cloud and arrow icon you can click to redownload them ahead of time and guarantee their availability when you are offline – or you can double-click one to get and open it immediately.

The Optimized Storage window

1 RECOMMENDED CHANGES

The window opens to this page, suggesting some key ways you can save on storage space.

2 ADDITIONAL CATEGORIES

Several items on the left detail space used by various apps, which you might want to reclaim.

3 MESSAGE ATTACHMENTS

This category lets you turn on auto-download of only recent attachments – or none at all.

4 MONITOR PROGRESS

The window needn't remain open, as you can simply reopen it to check lengthy tasks' progress.

Sierra - 19.63 GB available of 58.4 GB

Recommendations	
Applications	Zero KB
Documents	386.3 MB
GarageBand	463.2 MB
iCloud Drive	32.1 MB
Mail	1.23 GB
Trash	63 bytes
System	

1 Store in iCloud
Store all photos and videos in iCloud and save space by keeping only optimized photos and videos on this Mac when storage space is needed.

Turning on...

Optimize Storage
Save space by automatically removing iTunes movies and TV shows that you've already watched and by keeping only recent email attachments on this Mac when storage space is needed.

Completed

Empty Trash Automatically
Save space by automatically erasing items that have been in the Trash for more than 30 days.

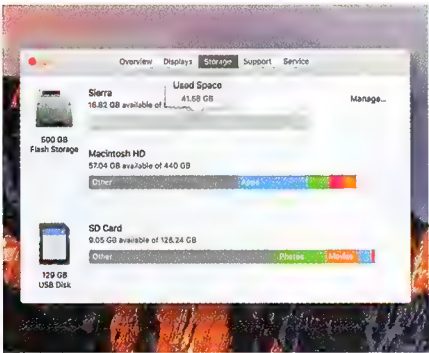
Completed

Reduce Clutter
Sort through documents and other content stored on this Mac and delete what is no longer needed.

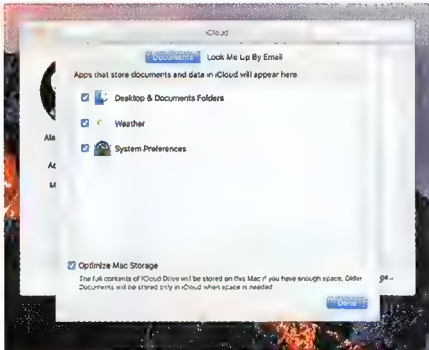
Review Files

Free up space on your Mac

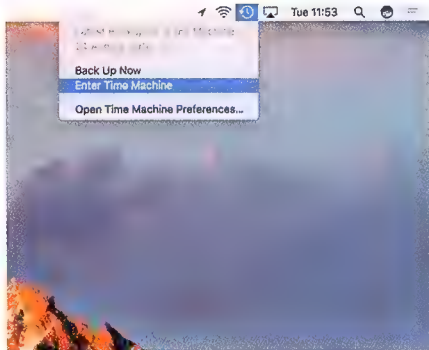
Follow these simple instructions to declutter your drive.



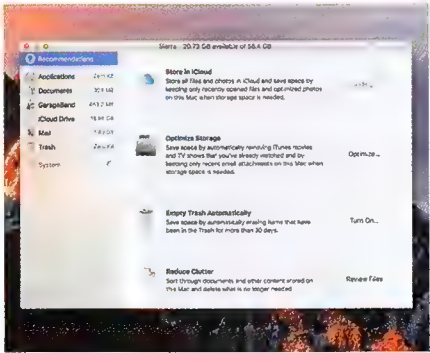
1 FIND THE FEATURE
Choose 'Apple > About This Mac' and then click the new window's Storage tab. This shows categorised breakdowns of used space on your Mac's directly attached storage. There's a Manage button next to only the current startup disk. Click it.



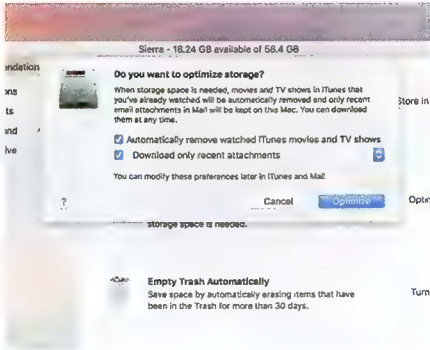
4 FILES IN ICLOUD DRIVE
Photos obtains a full-quality copy from iCloud when you edit a picture. As for files in Drive, accepting that idea turns on a new item in iCloud Drive's preferences that keeps only recently used files on your Mac if space gets low.



7 RECOVER LOST FILES
As long as you haven't excluded the Trash from Time Machine backups, open a window on the Trash in Finder and then choose Enter Time Machine from the service's menu bar icon. Browse back in time and restore the file, like any other.



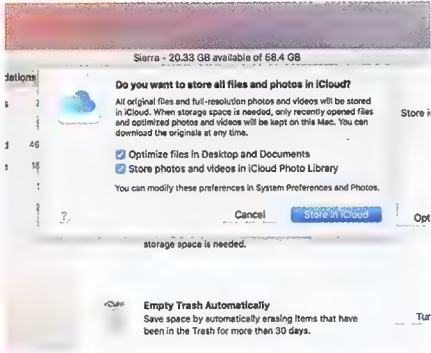
2 REVIEW ITS SUGGESTIONS
The Storage Management window opens, with Recommendations selected in its left pane. On the right, ideas of how you can save space are described, with a button next to each item. Click one for more info, then accept or ignore it.



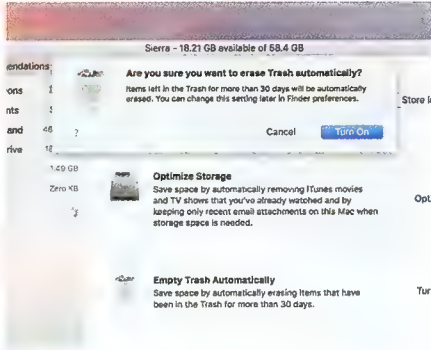
5 MOVIES AND TV SHOWS
The next suggestion is equivalent to turning on an item in iTunes' Advanced preferences. It instructs iTunes to remove movies and TV episodes from your Mac after you've watched them, potentially saving you lots of space due to their size.



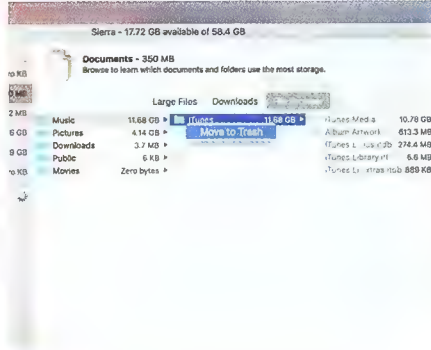
8 REDUCE CLUTTER
The fourth recommendation is the same as clicking Documents in the left pane. It can take a while for your drive's contents to be analysed before big items appear under Large Files, where they're listed with when they were last accessed.



3 STORE IN THE CLOUD
The first item's wording will suggest storing files and full-quality photos in iCloud, depending on whether you've already set iCloud Photo Library to keep optimised versions on your Mac if space is low (this was possible before Sierra).



6 AUTO-EMPTY THE TRASH
Sierra can be set to automatically remove items that have been in the Trash for longer than 30 days. This is the same as enabling an item in Finder's Advanced preferences. Past the grace period, items can still be recovered from Time Machine.



9 TRASH UNWANTED FILES
Select an item under Large Files, Downloads or File Browser and press the Spacebar to preview, or Command-delete to trash it. Be careful as File Browser is less safe than you might think; you can trash the folder that holds your iTunes library.



Customise the Linux kernel

Neil Bothwick shows you how to boost your geek cred and build your own Linux kernel.

When Linus Torvalds released the Linux kernel into the wild 25 years ago, it was as source code.

To use it, you had to configure and compile it. Things have moved on in the intervening years and distributions (distros) now supply a kernel already configured and compiled for the vast majority of hardware, yet still there are people that compile their own kernels. Why would you do this? There are actually a number of reasons for doing this that we will cover briefly before moving on to how to configure, compile and install a kernel and associated drivers.

Distro kernels are general purpose, they include almost everything that almost everyone needs, which means that you don't need most of what they come with. They are also built for a

generic CPU, which means, by compiling it yourself, you get a tighter kernel that is tailored to your hardware and usage. Distro kernels are generally well tested, but that takes time so you don't get the latest – for instance, Ubuntu 16.04 came with kernel 4.4.0 and it was already three months old at that point. A further three months later, it's using a slightly later revision of 4.4.0. The latest stable release from www.kernel.org is 4.6.4. This isn't a criticism of Ubuntu or any other distro, if you install their software, you expect it to be well tested. However, you may want or need features in a more recent kernel, such as drivers for recent hardware, such as the AMDGPU.

It may also be that your hardware requires a patch to the kernel to be fully supported, in which case, a recompile of the existing kernel may

suffice. If you want the maximum performance from your hardware – particularly if it's low-end or embedded – a custom kernel may make quite a difference. And, of course, there are the geek points to be gained when you tell people that you roll your own kernel.

TO THE SOURCE

So where do we start? That depends on whether you want the latest release or want to work with your distro's kernel. Most distros patch their kernels, for performance or compatibility, so starting with theirs may be a good idea. However, the patching is probably not as prevalent as it used to be – for example, distros no longer need to patch for their init system as they almost all use *Systemd*. If you want to start with your distro's kernel source, install it from your package manager

Patching your kernel

As previously mentioned, many distros apply various patches to their kernels. It may be that you need or want to do the same. These patches may be to support additional hardware or to enable extra features. They may not be in the main kernel source because they are too new, have not been sufficiently tested or are otherwise unsuitable.

To show how it's done, we will apply a patch that gives a greater choice of CPU optimisations. Download the ZIP file from github.com/graysky2/kernel_gcc_patch and unpack it. The latest release of the patch requires at least version 4.9 of the GCC compiler being installed. You can check which you have by running `gcc --version`. If yours is older, either upgrade or use one of the older versions of the patch from the ZIP file. Copy the patch file to your kernel source directory, cd there and

```
run $ patch -p1 <enable_additional...
```

The `-p1` option tells `patch` to ignore the first level of directories in the patch file. View the file to see what this means. Depending on the source of your patch, you may need to use a different figure here. The `patch` command will report a file not found if the value is wrong.

Now run `make menuconfig` and check the options under 'Processor type and features/Processor family' and you will see plenty more choices. If you are compiling a kernel to run only on the same machine, or identical hardware, pick the Native Optimisations option and the compiler will determine and use the best optimisations for that system. This will give a better performing kernel that one built to run on all x86-64 systems, at the expense of portability.

in the usual way. In Ubuntu and friends, the package you want is called **linux-source**. After installing it, you should find a tarball of the source code at `/usr/src/linux-source-x.y.z`. If you want to use the latest source from www.kernel.org, download the tarball.

Whichever option you chose, it is now time to open a terminal, switch to root with `su` or `sudo -i`, `cd` to `/usr/src` and unpack the tarball with:

```
$ tar xf
linux-source-4.6.4.tar.xz
```

Before we go any further, we must make sure we have a compiler and associated build tools installed. With Ubuntu, this is done by installing the **build-essential** package. You also need to install **libncurses5-dev** to be able to use the kernel configuration program. Now we can `cd` into the directory we've just unpacked and start configuring the kernel. The kernel is configured in a text file called `.config` in the main source code directory, but don't think about editing this by hand, it's well over 4,000 lines long. There's a program

to help you with this, so maximise your terminal window and run `$ make menuconfig`.

This presents a hierarchy of settings sections; move between them with the cursor up and down keys, descend into sections with Enter and toggle options with the space bar. Toggling on an option category will usually present more options. The left and right keys move between the actions at the bottom, Exit should really be labelled back, as that's what it does. It only exits the configuration program when pressed at the start screen. Help is self-explanatory. Hopefully, the same description also applies to what you see when you press it, further information on the highlighted option.

Despite previous comments about tailoring a kernel to your hardware, the first objective is to get a kernel that just works. That's not too difficult as most of the options have sane defaults. Once you have a working kernel, you can decide how much time you want to devote to optimising and tweaking it.

BUILT-IN VS MODULES

In the early days of Linux, the kernel was truly monolithic. It was a single file that included all the drivers, filesystems, network code and other options selected when compiling it. This became unwieldy as the range of supported hardware grew, so modules were introduced. These are extra bits of the kernel that exist as separate files (in `/lib/modules/kernel-version`) and are loaded into the main kernel when needed. When you press the space bar to toggle an option, some switch between showing a '*' for 'on' and nothing for 'off'. Others have a third option, 'M', which means the option will be built as a module. This is how distro kernels support so much hardware – they have modules for just about everything and the hardware detection magic loads the correct ones.

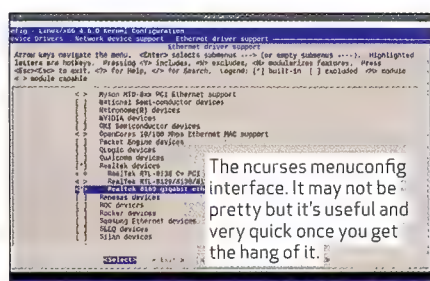
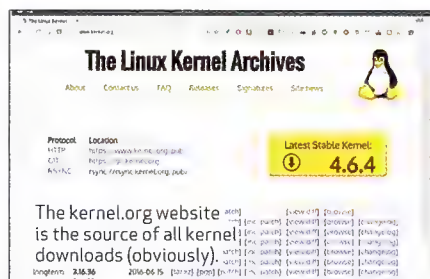
When building your own kernel, you don't need to include everything. Not only do they occupy disk space but building everything takes a lot longer than compiling just what you need. How do you decide whether to build something as a module or into the kernel? When you are compiling for a specific machine, a good rule is to build in drivers that you'll always use but create modules for things that are only used some of the time, such as on a desktop or server system, it makes sense to compile the driver for the Ethernet card into the kernel as you will always need it. On the other hand, a laptop will sometimes use wired networking, sometimes wireless and sometimes neither, so modules make more sense. Similarly, whichever filesystem you use for your root partition and the driver for your hard disk controller (usually the generic AHCI driver) should be compiled in.

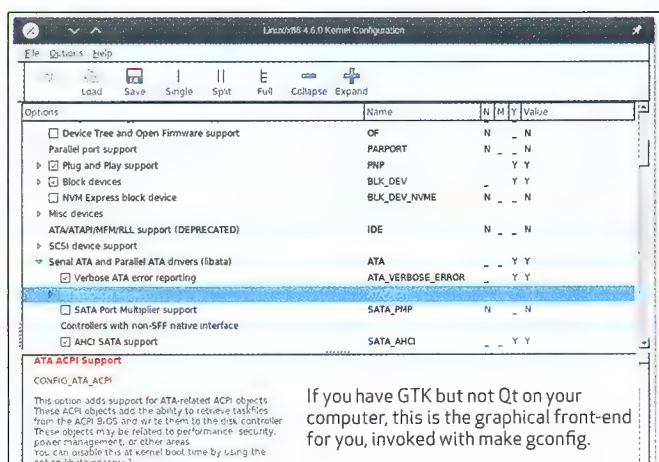
FAT filesystems, as used on USB sticks, and the USB mass storage driver itself could be modules. If you don't build in essential items, such as the root filesystem, you won't be able to boot your kernel without an initramfs, which we will look at shortly.

The ncurses interface of `menuconfig` is extremely functional but pretty basic in interface terms. There's also a nice GUI version, which require Qt. If you're using KDE, you already have this, otherwise install **libqt4-dev**.

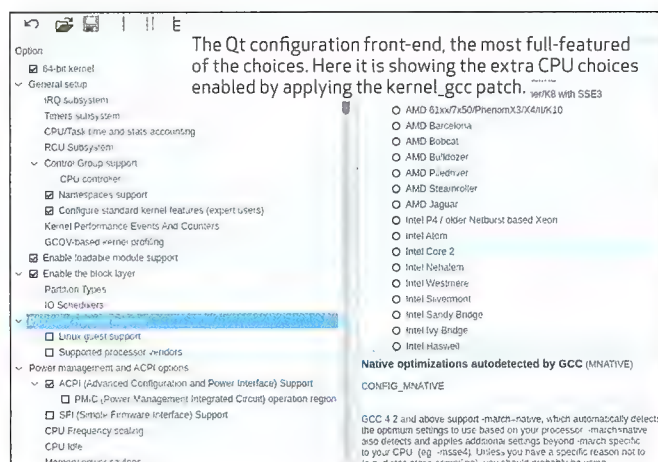
THE POINTY-CLICKY ALTERNATIVE

Then run `$ make xconfig`. There's also a GTK version with `make gconfig`, although it doesn't have all the features of the Qt version. Whichever interface you use, the procedure is the same. Let's start with some general features. Go to General Setup and enable 'Kernel.config support' and 'Enable access to .config through /proc'. The first stores the current kernel config in the kernel and the second makes it available through





If you have GTK but not Qt on your computer, this is the graphical front-end for you, invoked with `make gconfig`.



The Qt configuration front-end, the most full-featured of the choices. Here it is showing the extra CPU choices enabled by applying the `kernel_gcc_patch`.

`/proc/config.gz`. This can be incredibly useful when you're experimenting with different kernels. Go to 'Processor type > Features > Processor family'. This will be set to a generic x86_64 CPU by default. Unsetting the 64-bit kernel option will then give you a choice of 32-bit CPUs as well. This is the default when using a 32-bit OS.

Next, you need to make sure the modules for your hardware are configured. This is generally quite easy, thanks to the `lspci` command. This command lists all the hardware on your motherboard, onboard chips, as well as PCI cards, and with the `-k` option, it shows the module used by each device. If you don't already have a working kernel on your target machine, you can run this from a live CD.

```
$ lspci -k
07:00.0 Ethernet controller:
Realtek Semiconductor Co...
Subsystem: Gigabyte
Technology Co., Ltd
Motherboard
Kernel driver in use: r8169
```

So I need the `r8169` option for my network card, but where do I find that? Simple, if you're using the Qt config program, press `Ctrl-F` and type in the name of the module or anything else you need to search for. It will show you a list of matches, from where you can enable the one you want. Clicking on the option description shows information about it in the pane below. If you're using the `ncurses` config program in a terminal, press `/` to search. This shows a list of search results, and whether each one is enabled or not. Press the number alongside the one you want to go straight to it. From there, you can also view the help text for the option.

Sometimes, an option will show up in the search results but not be available as an option to select. This is because it depends on some other option being set first. The help screen for an option will often have a 'Depends on:' line that lists the options it needs and their current setting. Make sure they are all set to 'y' or 'm' (built-in or module). Usually there

are only one or two to consider but it can sometimes be a treasure hunt tracking down all the options you need.

MAKING THE KERNEL

So you've been through the configuration and got something you think is what you want, now it's time to build and install it. There are three commands to do this:

```
$ make all
$ make modules_install
$ make install
```

You can string them together in a single line like this:

```
$ make all modules_install install
```

But it's best to run each separately while you're getting the hang of things. If something goes wrong, you will know which stage failed. You shouldn't normally get errors during compilation unless you're using a patched kernel and the patches conflict. If you do get a build failure, paste the error message into your favourite web search engine. The first command builds the kernel

Troubleshooting

There are two types of people: those whose first kernel compiled and booted correctly and those who tell the truth. It can take a few tries to get it right, look at the sub-version number on distro releases, but you cannot break your system. This is because installing a new kernel version doesn't touch your old kernel, and your Grub menu will contain all the kernels it finds in `/boot`. So experiment away knowing you have a safety net. The most common failures, especially if you are not using an `initramfs`, are not including essential items like your hard disk controller and root filesystem type as built-ins. Remember, you cannot load any modules until the root filesystem is mounted.

The usual sign of a failure is a kernel panic, the kernel is doing it so you don't need to, or it simply stops with an error message. Read the error messages onscreen, you can scroll back a bit with `Shift-PageUp` providing the kernel is still running. The default scrollbar buffer is fairly small, but you can set it larger in the kernel with the `VGACON_SOFT_SCROLLBACK_SIZE` option — press `/` to find it! You can also override this setting by passing `fbcon=scrollback:Nk` to the kernel via the

bootloader, where `N` is the size in KB, but it's probably easier to set this to something like 128K in the kernel while you are experimenting. Speaking of bootloader options, you may want to disable the `GRUB_HIDDEN_TIMEOUT` option in `/etc/default/grub` so you see a menu with the kernel choices, just in case you need to select your fallback kernel. You should also disable any splash screens in here so you can see what is going on.

When you go back into your kernel source, make some changes, recompile and install, the previous version will be renamed with `.old`. The old `.old` version will be lost. If you want to keep track of all your experimental versions, you can either set `LOCALVERSION` in the config or create a file called `localversion` in the source tree. The contents of these will be added to the kernel version, so you can increment them as you go along. That will mean you could have a lot of kernels in `/boot`, feel free to delete any you no longer need, along with the accompanying `System.map` and `initramfs` files. You should also delete the corresponding directories from `/lib/modules`.



Construct a 4K-ready mini gaming PC

The question was asked: 4K gaming, microATX, SLI GTX 1080s — can it be done? Here's our response.

THE CONCEPT

There are certain things in the world that must remain as absolute truths. Nothing can exceed the speed of light; peanut butter and jam sandwiches have to be raspberry flavour; and PC gaming has to be done at 60fps. If these pillars fall, what are we but mere animals? And that brings us nicely to this Build It — or, more precisely, to one aspect of it. Let's face it, 4K monitors have been around for quite some time now. The increased screen real estate,

coupled with a large panel size, tends to lead to a more enjoyable desktop experience. However, finding any graphics setup capable of pushing all of those 8,294,000 pixels more than 60 times a second has been nigh on impossible, certainly in AAA titles. At least, until now.

So let's get to it. This particular rig was a challenge set by one of you. Last issue, we received a reader letter asking about the concept of a microATX, 4K-capable gaming PC.

The question, then, was simple: Is it possible, in today's age of 16nm FinFET graphics processors, to build a system capable of maintaining those crucial 60 frames per second at 4K in AAA titles, without fail, in a small enough form factor that you could keep it on your desk? Does SLI make sense in this regard, and what do you need to take into consideration when choosing your microATX chassis?

DESTINATION: 4K GAMING

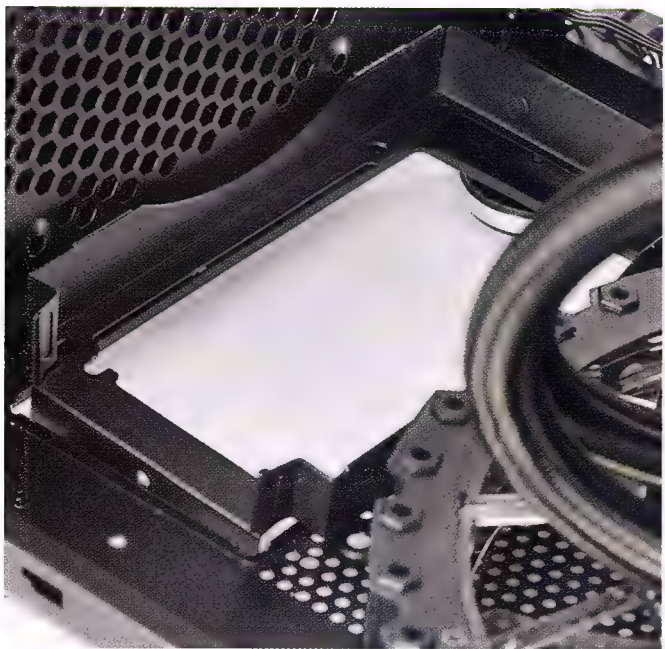
Where to start with such a unique build? You have two options: Either go all out, drop some cash on an Intel Core i7-6950X, two GTX 1080s, a Samsung 950 Pro, a 1,000W power supply, and a decent chassis — a build that ensures you keep your frame rates high and your credit score low. Or you can go down the more logical route, something more effective as far as price-to-performance goes — an Intel Core i7-6800K/5820K, and two GTX 1070s or GTX 980 Tis. We thought about it long and hard — no, seriously we did, like for at least five minutes — and then we decided: To hell with logic! An Intel Core i7-6950X and two GTX 1080s it is — and we'll try to take a look at GTX 1070 SLI performance a little further down the track.

But how do you house all this hardware in a footprint that you can pop on top of your desk? The choice was between a Corsair Carbide Air 240, with a compartmentalised interior and ease-of-use build features, or the more compact and stylish BitFenix Phenom M-ATX. The Phenom won out. The Intel Core i7-6950X is no chilly chip, whether or not you overclock it, and slapping two Founder's Edition cards in there, with blower-style shrouds, gives little breathing room. The Phenom has support for a 230mm BitFenix fan in the

PARTS LIST		
PART		STREET PRICE
CASE	BITFENIX PHENOM M-ATX	\$129
MOTHERBOARD	ASROCK X99M EXTREME4	\$230
CPU	INTEL CORE I7-6950X	\$2,649
MEMORY	CORSAIR VENGEANCE LPX 16GB (4X 4GB) @ 2,400MT/S	\$116
GPU	2X NVIDIA GEFORCE GTX 1080	\$2,298
PSU	CORSAIR HX1000I	\$305
STORAGE	SAMSUNG 950 PRO (512GB)	\$410
COOLING	CORSAIR H80I GT, IX NOCTUA NF-F12 IPCC 120MM	\$194
TOTAL		\$6,331

floor, and a 120mm fan in the rear, so we can use all the hardware we want without encountering any undesirable temperatures.

"So let's get to it. This particular rig was a challenge set by one of you. Last issue, we received a reader's letter asking about the concept of a microATX, 4K-capable gaming PC."



1 GHETTO MODIFICATIONS

There's nothing like good ol' Aussie ingenuity to overcome problems. So what's the issue here? Well, when building our rig, we noticed that, once the motherboard and PSU were installed, the option to install a GPU in the top PCIe slot wasn't possible, as it conflicted with the PSU — it was too long to work with the standard ATX power supply. To get around this, we removed the PSU mounting bracket, then reinstalled half of it by ghetto-mounting it to the bottom of the chassis, running the passthrough cable underneath it, then mounting the PSU to the remainder of the bracket. Although it doesn't look pretty, it resolved an immediate problem. A long-term fix would be to use a Dremel to mount the piece to the chassis, then cut a section out to allow the PSU passthrough cable to sit comfortably.



2 HIGH-BANDWIDTH SLI BRIDGES

We haven't had the opportunity to talk about Nvidia's latest high-bandwidth SLI bridge in the magazine yet, but we have to say, aside from looking spectacularly pretty, we've seen no noticeable difference in frame rate outside of margin for error, even at 4K. One thing this mighty pretty SLI bridge does do, however, is ensure that your GPUs don't have the structural integrity of a chocolate soufflé. Once you've got this installed, the two cards are rock solid, and in an inverted build like this one, that can be incredibly handy, especially if you're transporting your machine around. On the other hand, they're quite pricey to get a hold of, add very little with regard to performance and, considering this chassis is windowless, it may be worth leaving the bridge out in favour of spending the cash elsewhere.



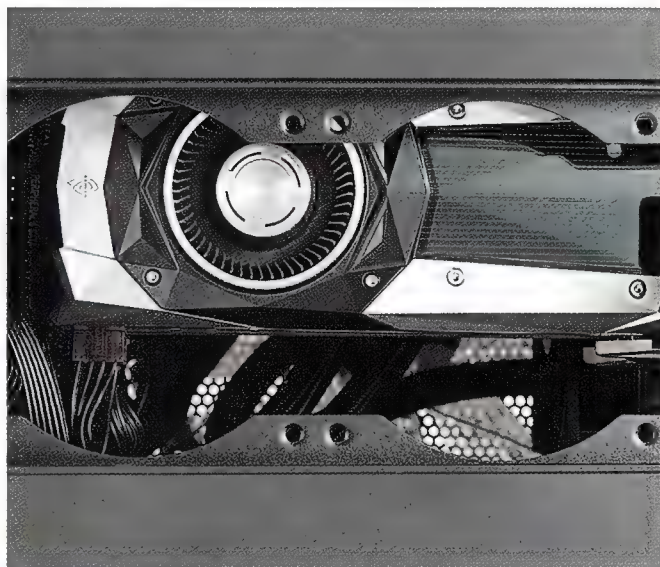
3 AIO COOLERS AND MEMORY WOES

Although the Phenom's spec page states that it supports a single 140mm fan in the rear, that doesn't mean a liquid cooler will fit. This is due to the radiator being bigger than the fan, particularly the reservoir that you can see below it. If you try to opt for a 140mm radiator, such as the NZXT Kraken X41 (our first choice), you're going to run into issues mounting it to the chassis. Then there's the fan conundrum; in this case, we opted to install it in a pull configuration, to maintain a positive pressure system, while also making it far easier to mount. It's also worth noting that we used low-profile memory — anything higher and you're going to struggle to install that rear I/O cooler. And if you're thinking of using an air tower, by blocking that airway by the 230mm intake fan, you'll end up stifling your GPUs.



5 CABLE MANAGEMENT? WHAT'S THAT?

If you've taken a look at that last image, you've probably decided we're really lazy, and couldn't be bothered to tidy up our cables. On the contrary — due to the orientation and positioning of the PSU in this chassis, there's very little room for us to move those cables around. It is possible to route some of the cables behind the motherboard tray through clever planning, but the vast majority of them need to sit on top of the PSU. Fortunately, it's not too much of an issue, because this is a windowless chassis, and as long as you're not blocking your 230mm intake fan on the bottom, all will be well in the world of thermals.



4 EXTRA INTAKES

Here's another prime example of an opportunity to get some modding in. What would be perfect here would be two additional 120mm fans running as intakes, blowing cool air on to the two GPUs. Unfortunately, with the vent off, it's just a touch too cramped to install two 120mm fans, because most are too deep to install with the dust filter as well. What you could do is either opt for two slim 120mm fans (Silverstone's Tek Professional Slims come to mind), or mod a new top fan cover with an extra half inch or so of height, to compensate for normal-sized fans. That way, you could drive even more air into the chassis, keep those two blower coolers well fed, and improve your overclocking headroom in the process.



6 SIDE PANEL I/O

BitFenix has taken an unusual route when it comes to the front I/O panel. Instead of embedding it on the top of the chassis, it's on the motherboard-facing side panel. The problem with this is that most of the front I/O connectors on motherboards are located just under the uppermost GPU, so in an SLI system, you'll have to plug the 'front' panel I/O in before you install the final GPU. Fortunately, there is a way around this. If you take a look at the side panel, you'll notice the front I/O and HD audio are connected via a white plastic locking port — pull them out of the socket here, plug the connector ends into the headers on the motherboard, install your GPU, get your system all wrapped up, then plug them back into your side panel, and lock up shop. Job done.



1 This was one of the trickier builds to work in with regard to cable management. You might notice it becomes particularly cramped when installing both the 8-pin EPS power (see bottom-middle) and the 24-pin — an easy trick to unhook these is to use a key. Simply wedge it down from the top of the notch, press down, and pull the cable up and out.

2 There's going to be a fair amount of tension on that tubing when you're installing the AIO liquid cooler. But don't worry too much about it — Corsair assured us that the H80 is designed to take this level of strain, thanks to the cable braid that surrounds those water funnels.

3 The advantage of having a large fan like this is that it's exceptionally quiet, relatively speaking, certainly in contrast to 120mm or 140mm fans. Couple that with the insane amount of airflow it can draw in, and you're all set. Just remember to remove the solid dust filter located below before you install it.

4 What we would suggest if you are looking to build a 4K rig with two graphics cards, is that you opt for either a low-end X99 processor (the Intel Core i7-5820K or 6800K come to mind), or one of the latest Skylake processors.

"Regarding the build process, there's no denying it was a nightmare. But that's always going to be the case with the vast majority of microATX and ITX systems."

4K Gaming Achieved

The idea was to build a system capable of gaming at 4K, that you could fit on your desk, and keep out of the way of pesky ungrown humans and furry animals. It's an admirable pursuit. Over the next two or three years, it's likely we'll see 4K gaming becoming more prevalent, certainly with the advent of DisplayPort 1.3 and 1.4, and 120Hz-plus monitors bounding toward us at breakneck speed. Hopefully, 60Hz panels will drop to 1080p levels — at least, that's the dream — enabling us to appreciate the glory of those high pixel-density displays.

Did we achieve our goal? Sort of. Two GTX 1080s in SLI certainly make 4K gaming a reality, but it comes with its caveats. Power draw is the first issue. Even though Nvidia utilises the 16nm FinFET process, the overall draw of both these cards is still significantly higher than the pinnacle of Maxwell, AKA the GTX 980. Then there's the SLI profiles. Not all games support multiple GPUs, as it's mostly down to the devs to code that in, and even those that eventually do, most don't support it at launch. After all, the devs want to get their games out on time, and with the vast majority of gamers not taking advantage of two-way SLI or CrossFire, it's not a priority.

Then we have to deal with temperatures. Although we kept them

within reasonable parameters (only three degrees higher than our recorded maximum on our test bed) with a tweak of the fan settings and some ingenious cooling layouts, it may not have worked as well with open-air-style coolers.

As for performance, this little beauty did admirably. At 4K, we saw an average of 71fps in *Far Cry Primal*, 64fps in *The Division*, and 35fps in *Rise of the Tomb Raider*, all on the absolute cutting edge of graphical settings at 4K. One thing to note, however, is that with SLI enabled, *Far Cry Primal* at 1080p scored 20fps less than with it disabled, proving once more that SLI is not perfect. In computational benchmarks, the Intel Core i7-6950X

didn't disappoint, scoring an impressive 2,155 points in Cinebench, and 8,758 in PCMark 8 Creative.

Regarding the build process, there's no denying it was a nightmare. But that's always going to be the case with the vast majority of microATX and ITX systems. There's little room to move in such a small chassis, and cable management is a problem. In hindsight, it would have been much nicer to work inside the Corsair Carbide Air 240, as it is compartmentalised, which allows for cable management and better airflow. However, the Carbide Air 240 is relatively new, while the Phenom is less so, so hopefully, in the future, we'll see BitFenix produce something of a similar calibre, if not better. ■

BENCHMARK RESULTS

	LABS SYSTEM	THIS SYSTEM
CINEBENCH R15 MULTI-THREAD	987	2155 (118%)
CINEBENCH R15 SINGLE THREAD	196	153 (-21%)
TECHARP'S X264 HD 5.0.1 (FPS)	21.93	34.39 (57%)
PCMARK 8 CREATIVE	7,675	8,758 (14%)
RISE OF THE TOMB RAIDER	41	91 (122%)
FAR CRY PRIMAL	76	76 (0%)
THE DIVISION	78	148.4 (90%)

Our APC Labs system uses a Core i7-6700K CPU @ 4.6GHz, an AMD R9 Fury X, and 32GB of RAM. All games are tested at 1080p on max settings, with HD texture packages installed.

DIY R-Pi dead man's switch

Nate Drake shows how to turn your Pi into a handy dead man's switch to send emails or update websites for you in case the worst happens.

Did you have the misfortune to sit through *Superman IV: A Quest for Peace*? If so, you'll remember a scene where the Man of Steel is forced to stop a subway train that has shot off down a tunnel. After single-handedly halting the train and saving everyone on board, Superman takes the time to reassure the public that the subway system is one of the safest ways to travel. This is in fact true, because while the fictional Metropolis may not make use of them, real-life subway trains have a dead man's switch – a control that has to be continually pressed in order for the train to move.

With the invention of inexpensive computers, it's now extremely easy to set up a digital dead man's switch. Wikileaks, for instance, has released a number of encrypted files of classified information, the password for which will be released if anything happens to any of the founders.

Traditionally, a dead man's switch is time-based, like Google's Inactive Account Manager, which allows you to nominate someone else to access your emails, documents and photos if your account is inactive for a period of time.

Not all applications of the switch concept are a safeguard against being arrested or dying. The website TimeCave, for instance, enables you to schedule an email at any point in the future up until 31 December 2025. This naturally can be anything from the location of your family's silverware to a few heartfelt messages for the people you love.

DEAD MAN CODING

In this tutorial, we'll show you how to turn your Raspberry Pi into a dead man's switch. The Pi is perfect for this given the minimal amount of power it uses and the coding required.

In order to proceed, you'll need a Pi, ideally with a clean install of Raspbian on it. The Pi Zero is ideal for this purpose as the dead man's switch is very low on system resources. This tutorial also assumes that you know how to connect to your Pi over SSH and know a few basic Terminal commands.

It's important before starting to decide what you wish your Pi to do. Perhaps you have an elderly relative who wants to check in with you regularly? Alternatively, you might want the Pi to delete your personal

```
seconds.
lastaccessed=$(stat -c %Y
#BASH_SOURCE)
timenow=$(date +%s)
let timeleft=(#timenow-
#lastaccessed)

if [ $timeleft -gt $timelimit
]
then
#place commands here
#sh ./ftp.sh
#sh ./email.sh
#shred -u /home/pi/
mysecretfile.txt
fi

END_SCRIPT
exit 0
```

The script naturally has to be placed into a file and made executable on the Pi. (See the box 'Set up your dead man's switch'.) This guide also includes templates for two very basic shell scripts which can be called by the dead man switch script itself. One enables a web page to be updated to notify that the dead man's switch has been tripped. Another will send out an e-mail to any address with the message of your choice. If you decide to use the FTP script, you will need access to a domain which allows access via FTP. There are a number of providers that will allow free web hosting plans if you don't have a domain of your own. The template for the email shell script makes use of a Gmail account. It makes sense to set one up specifically for the project.

In either case, if you wish to make use of these scripts, simply remove the # to uncomment the lines in the main switch script above. If you don't wish to broadcast the fact the dead man's switch has been tripped, it's just as feasible to protect your files with a password or run a backup. There's also a 'reset switch' script which will prevent the switch from being tripped for the next X hours. This would need to be executed periodically, for instance, by your dear old Nan to make sure an email isn't sent out to prompt you to come and check on her. Where there's a will there's a way.

For the sake of simplicity, we'll assume that all scripts are located in the Pi's home folder, but you can place them elsewhere if you wish. By now, the basic premise should be clear, and

"The dead man's switch isn't foolproof. The legality of warrant canaries has yet to be tested in US/UK courts, and some countries, such as here in Australia, have banned them outright"

Quick tips

- This tutorial will work on any computer running a Debian-based distro of Linux, so feel free to experiment with other computers if you wish.
- When it comes to creating a warrant canary, try to be imaginative. Instead of just posting some text or an image, why not regularly record a video to say that as of this date, you've received no warrants?

files if you fail to reset the switch after a certain amount of time.

The dead man's switch itself works by way of a shell script which is regularly invoked by the scheduling utility cron on the Pi. The script will check to see if the period of time you specify (by default this is 24 hours) has lapsed and, if so, carries out your commands.

The script itself couldn't be simpler:

```
#!/bin/bash
```

```
# Dead Man's Script
```

```
timelimit=86400 #Time period
before tripping switch in
```


we strongly encourage you to adapt it to your own needs. If the reset switch is not executed, the script will keep executing itself every X hours. This means, for instance, that the script for the web page will keep updating to say the dead man's switch has been tripped and list the date and time. This feature can be employed to create your own warrant canary.

Warrant canaries have sprung up in the wake of 9/11 in response to shadowy government organisations placing secret subpoenas on companies to hand over information. In 2013, Ladar Levinson, the founder of the privacy-oriented email service Lavabit, came under pressure from the NSA to insert a secret backdoor into his own software, supposedly in a bid to track down Edward Snowden, who had previously used the service. Levinson was bound by law not to alert users that their data could be compromised by this, and so chose to shut down his service rather than undermine users' privacy.

CANNY CANARY

As an alternative to shutting down or facing arrest for breaking the law, some companies choose to publish regular reports saying that, as of this date, they have not been subject to such an order. If the company fails to confirm that they have not been served a secret warrant, this may not violate a gag order but users will know that their data isn't safe.

If you do decide to use the Pi as a warrant canary, you may wish to change the text of your web page or email to say words to the effect of "Nothing to see here" or something more specific such as "As of today, we have received no warrants for one or more users' data".

Sendemail Simplicity

For the purposes of this guide, a Gmail account will be used to send an email when the switch is tripped, but the sendemail program can be used with any SMTP server provided you have the details. If you're happy to use Gmail, head over to www.google.com/settings/security/lesssecureapps to switch on access for 'less secure' apps.

Next, on the Pi, you'll need to install the sendemail program and its dependencies:

```
sudo apt-get install sendemail libio-socket-ssl-perl
...and once this is all installed, type nano email.sh to create an empty file and paste in the following script, modifying it as needed:
```

```
#!/bin/bash
# Send e-mail script
sendEmail -o tls=yes -f yourgmailaddress@gmail.com -t
recipientsaddress@domain.com -s smtp.gmail.com:587 -xu
yourgmailaddress@gmail.com -xp yourgmailpassword -u "Dead
Man Switch" -m "Hi. This is an automated message from
your Dead Man's Switch. The switch has been tripped."
END_SCRIPT
exit 0
```

Use Ctrl-X to exit, saving your changes. Next, run `chmod a+x email.sh` to make the FTP script executable.

Make sure to remove the # at the beginning of `#sh ./email.sh` in the main `script.sh` in order to invoke this if the switch is tripped.

The dead man's switch isn't foolproof. The legality of warrant canaries has yet to be tested in US/UK courts, and some countries, such as here in Australia, have banned them outright. The switch also needs to be physically secure, because if a burglar were to break into your old Granny's house, they could trip the 'reset' switch as easily as she could, ensuring that her SOS email wouldn't be sent out. Also, if you're relying on the device to send an email or update a web page but it's disconnected from the internet for any reason, naturally the required action won't be carried out even though the switch is tripped.

Additionally, if you're using your switch to delete data from a drive, it may be possible to use digital forensics to piece the data back together, so it's probably best to couple it with an email asking one of your loved ones to physically destroy your SD card/USB stick too.

Note: The FTP script doesn't encrypt data between the Pi and the website, so in theory, someone could snoop on your connection and modify the website to suit themselves. You can circumvent this by using the sftp command or, if your domain provider allows, use SSH to connect to your website. ■

Set up your dead man's switch

```
#!/bin/bash
# Dead Man's Script
timelimit=86400 # Time period before backup script
lastaccessed=$(stat -c %Y $BASH_SOURCE)
timenow=$(date +%s)
let timeleft=$((timenow-lastaccessed))

if [ $timelimit -lt $timeleft ]; then
    # Replace commands here
    #sh ./ftp.sh
    #sh ./email.sh
    #sh ./u /home/pi/secretfile.txt
fi
```

1 CREATE A SWITCH SCRIPT

In your Pi's home folder, type `nano switch.sh` to create a file. Next paste in the script from the tutorial. (You may want to comment out lines to invoke FTP/e-mail scripts.) When you're done use Ctrl-X to quit, save, then run `chmod a+x script.sh` to execute the switch.

```
pi@raspberrypi:~
File Edit View Search Terminal Help
GNU nano 2.2.6 File: /tmp/crontab.jci90E/crontab
# daemon's notion of time and timezones
#
# Output of the crontab jobs (including errors) is sent
# email to the user the crontab file belongs to (unless
#
# For example, you can run a backup of all your user ad
# at 5 a.m. every week with:
# 0 5 * * 1 tar -zcf /var/backups/home.tgz /home/
#
# For more information see the manual pages of crontab
#
# h dom mon dow command
0 0 * * * /home/pi/switch.sh
```

2 SCHEDULE A CRON JOB

Simply run `crontab -e` to open the Cron scheduling utility which will act as our countdown timer. Choose Option 2 to edit using nano and at the very bottom of the file paste `0 * * * * /home/pi/switch.sh`. Use Ctrl-X to exit, saving your changes.

```
pi@raspberrypi:~
File Edit View Search Terminal Help
GNU nano 2.2.6 File: reset-switch
#!/bin/bash
touch /home/pi/switch.sh
```

3 CREATE A RESET SWITCH

Type `nano reset-switch.sh` and paste in:

```
#!/bin/bash
touch /home/pi/switch.sh
```

Exit and type `chmod a+x reset-switch.sh` to make the reset switch executable. In future, run `./reset-switch.sh` to reset the switch.

Everything you need to know about Android 7.0

Google officially launches its Nougat-flavoured mobile OS. Darren Yates looks at the new security features within Android 7.0... and why your device probably won't get this new OS.



It looks like a season of change is hitting Google-land, with rumours the long-serviced 'Nexus' brand is to be retired (tinyurl.com/jmu6gyd) and replaced by 'Pixel' and 'Pixel XL' monikers (tinyurl.com/gu9q6aa), plus the first shoots of a new from-the-ground-up operating system (OS) called 'Fuchsia'. But it's the release of the new Android 'Nougat' update that, for the moment, is catching eyes.

No doubt you've already read about the more up-front features such as split-screen multitasking, Doze on the Go and Notification Direct Reply. But with greater interest in mobile security and privacy than ever before, the latest security measures inside Android 7.0 are well worth a look. Also, we'll dive into the issue of Android OS updates, which devices are likely to get Nougat – and why yours probably won't.

BRIEF FEATURES LIST

But just in case you missed them, briefly, here are some of Nougat's bigger-ticket items.

Arguably, the most noticeable is new split-screen multitasking that allows you to run two apps either above-and-below or side-by-side on larger phones and tablets. As we mentioned in the July issue of APC, the Recents button (that's the square one on the right) will split in two when you're multi-windowing and you can resize the windows by dragging the centre border between the two. There's also the new quick-switch system that lets you double-tap the Recents button between the two most recent apps, with copy-and-paste support.

New 'Doze on the Go' is a tweak to the Doze power management feature introduced in Marshmallow/6.0 that auto-reduces power consumption when the phone is left alone. In Nougat/7.0, Doze gets updated to handle when you're on the move, allowing the device

to remain in sleep mode, saving battery power.

But for 'most popular feature', our money's on Notification Direct Reply, which enables you to reply to messages in the Notification panel without having to open up an app.

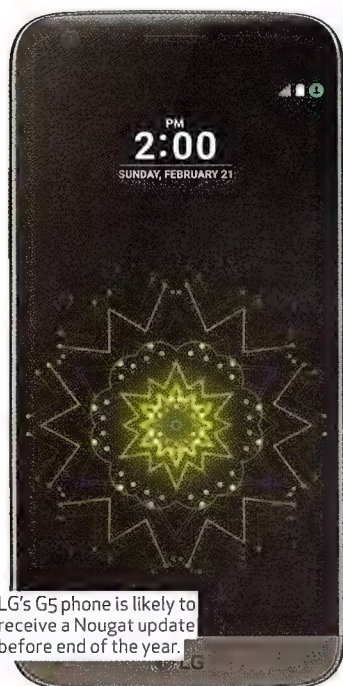
NEW JIT COMPILER

Back when Google launched Froyo/Android 2.2, it heralded the arrival of

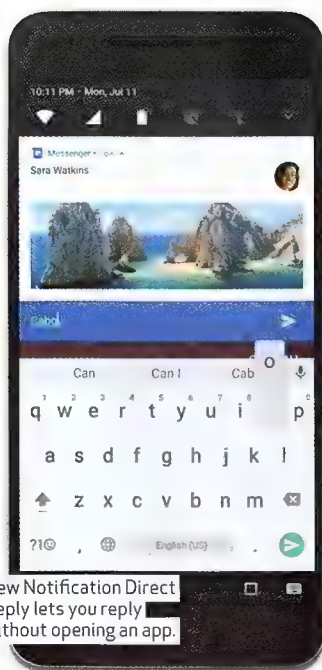
a new Just-In-Time (JIT) compiler that took Java application code and compiled it right before it was required by the device's processor – as the name says, 'just in time'. The performance gains compared with Éclair/2.1 were extraordinary, as anyone using Android back then would attest to – as much as five times faster. But as device processing power cranked up, Google changed tack and introduced a new

Version	Codename	API	Distribution	Distribution of Android versions still in use. (Source: Google)
2.2	Froyo	8	0.1%	
2.3.3 - 2.3.7	Gingerbread	10	1.7%	
4.0.3 - 4.0.4	Ice Cream Sandwich	15	1.6%	
4.1.x	Jelly Bean	16	6.0%	
4.2.x		17	8.3%	
4.3		18	2.4%	
4.4	KitKat	19	29.2%	
5.0	Lollipop	21	14.1%	
5.1		22	21.4%	
6.0	Marshmallow	23	15.2%	

Data collected during a 7-day period ending on August 1, 2016.
Any versions with less than 0.1% distribution are not shown.



LG's G5 phone is likely to receive a Nougat update before end of the year.



New Notification Direct Reply lets you reply without opening an app.



No guarantees yet, but the Galaxy S7 series should receive Nougat updates.

"Anyone who's used Android for more than the last year or so will know how much fun Android updates can be."

'ahead of time' (AOT) compiler in KitKat/4.4 called 'Android RunTime' or ART. The idea was that, as CPU hardware was no longer so constrained that we couldn't afford to compile apps before using them, we could now move to a more overall-efficient compiling setup. From Lollipop/5.0, AOT compiling became the exclusive option.

However, in a surprise move, Nougat is sending us back to the future with a new JIT compiler (tinyurl.com/jde8mvx) – but this time, working in conjunction with AOT compiling to improve app installation times by as much as 75% and reduce app size on your device by up to half.

NEW SECURITY FEATURES

These days, however, there's as much interest in security and privacy provisions within new Android updates as there is in any shiny new toys we get to play with. Google knows this and continues to beef up security in its latest update, while at the same time, making these features more user-friendly.

One of these receiving a user experience overhaul is Trusted Face, Android's facial recognition lock system. Originally known as 'Face Unlock', Trusted Face has been available since Lollipop/5.0, but Google says Nougat now has a new 'face

recogniser' that copes better with varied lighting conditions, glasses, even how you hold the device. The downside is it'll only be available on 'selected devices'.

FILE-BASED ENCRYPTION

Encryption in one form or another has been around in Android since the days of Gingerbread/2.3. Come KitKat/4.4, it evolved into full-disk encryption (FDE) where everything on the device was encrypted with a single minimum 128-bit key. By Lollipop/5.0, fast encryption was added to only encrypt storage blocks that had data stored in them, helping speed up first-boot times (tinyurl.com/hcgfe3u).

Now with Nougat, Google introduces file-based encryption (FBE) that encrypts individual files with separate keys and overcomes the problem of FDE locking up almost everything bar the power button without you first entering your credentials into the device. According to Google, FBE allows Nougat a new feature called 'Direct Boot', which enables booting into the lock screen as well as other non-privacy-threatening actions such as answering phone calls, without having to first unlock the device.

FBE creates two separate encrypted storage areas – Credential Encrypted (CE) and Device Encrypted (DE) storage.

Credential Encrypted storage is the default option but requires the user to unlock the device before access is allowed, while Device Encrypted storage is available in both Direct Boot mode and after unlocking.

However, it looks as though FBE may add some overheads – Google doesn't say "FBE takes a chunk of your device's performance", but it does suggest "manufacturers electing to use FBE may wish to explore ways of optimising the feature based on the system-on-a-chip (SoC) used". Further, it also lists a minimum encryption speed at the kernel of 50MB/second "to ensure a good user experience" (tinyurl.com/znvwhvj).

SEAMLESS FIRMWARE UPDATES

Anyone who's used Android for more than the last year or so will know how much fun Android updates can be. We'll delve deeper into this shortly, but first, it looks as though Android 7.0 is about to address this with what it's calling 'seamless updates'.

Rather than having to drive the process yourself, Nougat will download Android updates in the background to a second storage partition. You'll get an alert when the new update is ready and the next time you reboot the device, the active partition will switch over to the new update – or so we believe, given there were no devices supporting 'seamless updates' as of Nougat's launch. However, it's not expected to be a 'Windows 10'-style compulsory update and you'll be able to choose whether to or not.

Still, it sounds pretty good, doesn't it? Hold your horses – that requirement for two partitions

apparently isn't set in concrete, which means seamless updates could be optional for phone makers. And it won't work on existing devices, either, since they typically only have the one partition and trying to turn one partition into two could go pear-shaped real quick (unless, possibly, you gain root-access, wipe and flash a custom ROM from scratch). Another downside is that since you'll need two partitions with full Android systems on each at some point, it's going to require a fairly chunky phone in terms of on-board storage for it to work – and how much storage you'll have left is anyone's guess at the moment (tinyurl.com/han89x8). But most of all, it's still unclear when or how often these updates will actually appear.

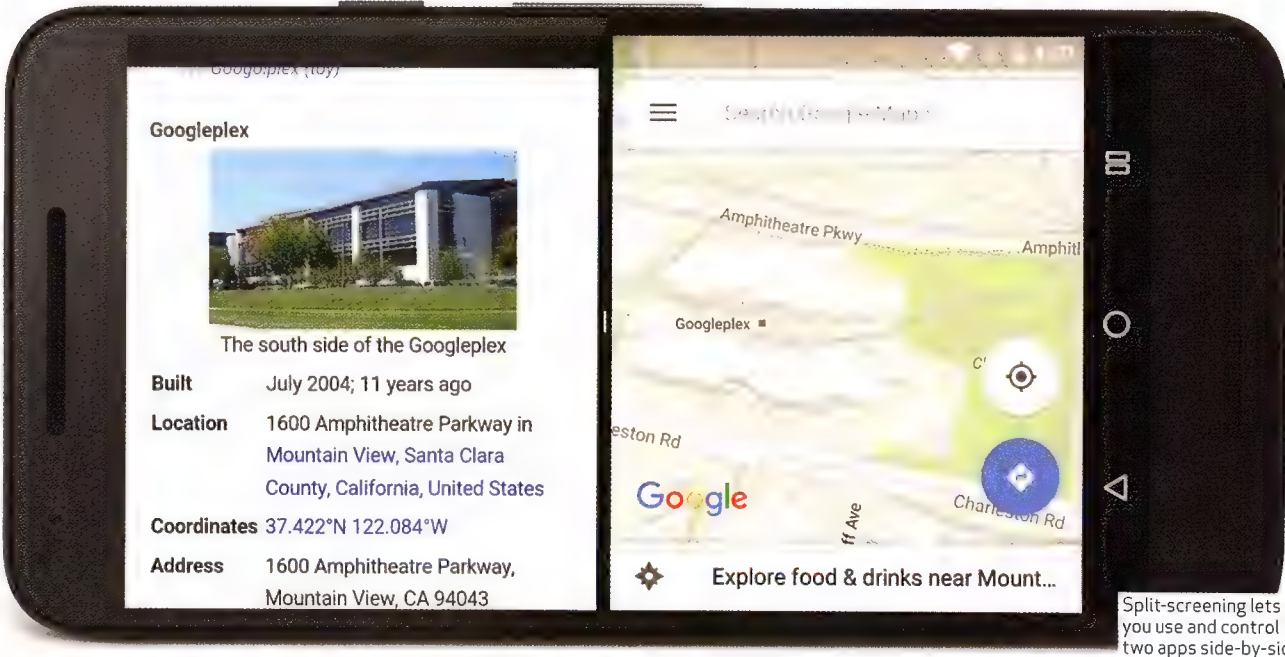
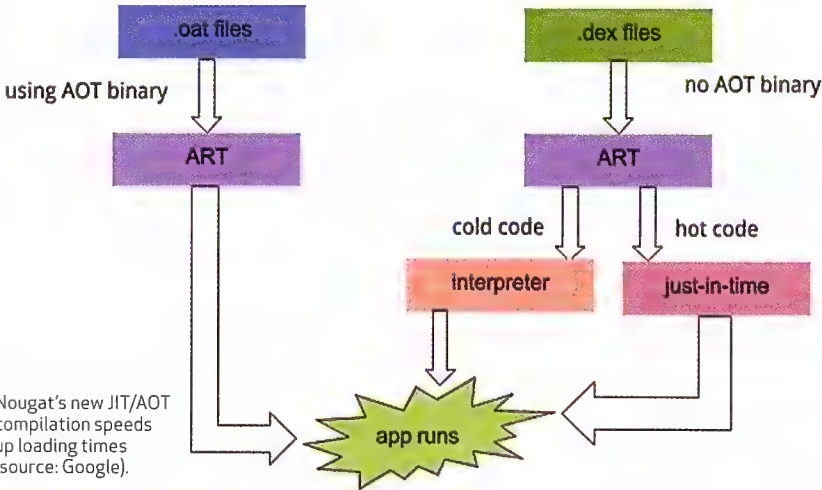
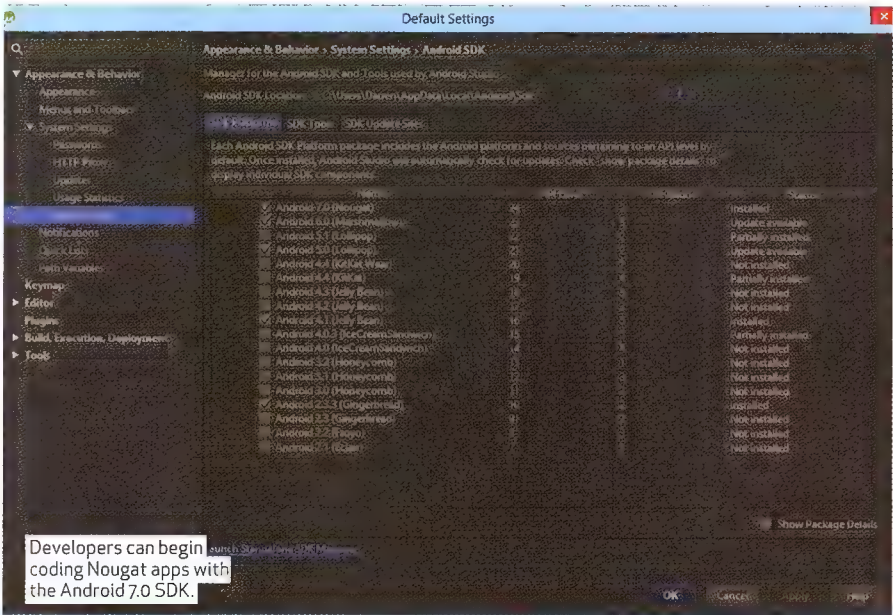
WHO GETS NOUGAT?

So which devices will get Android 7.0? As you'd expect, a decent number of the Nexus-branded devices, including the Nexus 5X, 6/6P and 9 will soon receive an update, if not already. So, too, the Pixel C. Sadly, anything older looks like getting the chop – including the LG-built Nexus 5. We'll explain why in a moment.

As for new devices, LG's upcoming 5.7-inch V20 should be first cab off the rank with Nougat pre-loaded, powered by Qualcomm's Kryo-cored Snapdragon 820 chip. If you're lucky, the LG G5 may also be one of the first existing non-Nexus devices to get Nougat by the end of the year.

WHAT ABOUT OLDER DEVICES?

As for other kit already in your pocket, a decent chunk of Sony phones are said to be lining up for Nougat, including most recent Xperia Z-series models





Sony's Xperia Z5 Premium is one of a number to get Nougat at some point.



The HTC 10 is another to line up for an Android 7.0 update.

from the Z3+ up, as well as the Xperia X-series. Samsung hadn't said anything official at time of writing, but the S7 and S7 Edge would likely be safe bets for Nougat updates, as would the Galaxy Note 7, depending on what happens after the recent recall (tinyurl.com/zuen3yz). Meanwhile, HTC is said to be aiming for One M9, One A9 and 10 updates by the end of the year and the Motorola Moto G4 Plus is also thought to be on the list. Still, we'll be surprised if any updates get past local telcos before the end of the year.

WHAT ABOUT THEM?

However, for many Android users, this is all likely to be academic. The one question every Android user asks at this time of year is "When will my device receive the new OS update?" and the most likely answer is "It won't".

Android OS updates have become a bit of a lottery and it can seem as though there is little rhyme or reason as to which devices get the lollies and which ones don't. Conventional wisdom has been that whether or not a device receives an update is up to Google, your device manufacturer and your network provider. All three need a conveyor belt of testing – the update itself, the update on the device and then the update on the device on the network – before you get the 'warm fuzzies' of an update alert.

SNAPDRAGON 800/801 SOCS

Frankly, we imagine the process is like trying to herd cats. However, there's actually a fourth feline in this update roundup – the device CPU or 'SoC' (System on a Chip) maker. The vast majority of smartphone makers don't manufacture their own chips – they

leave that to the likes of Qualcomm, MediaTek, HiSilicon and others. However, rumours are swirling that any device with a Qualcomm Snapdragon 800 or 801 SoC inside will not receive an official Nougat update (tinyurl.com/jyh7l28). If the rumours are true, it'll leave a sizeable chunk of the class-of-2014 off the update list. We already know LG's Nexus 5 is officially a Nougat no-go, but it could also potentially affect the Samsung Galaxy S5, HTC One M8, LG's G3 and the Sony Xperia Z3 range. There's a terrific read over at XDA Developers on the subject (tinyurl.com/gwc7bvu, warning: gets technical).

NEW RULE OF THUMB

This would also follow our normal update rule-of-thumb which surmises that, if your device is less than a year old, you'll likely get the new OS update; less than two years old, maybe you'll get it; and two-years or older, just forget it. But with the continued rise of new, very low-cost pre-paid Android smartphones being sold in Australia, that rule-of-thumb advice also needs updating: if you have a new budget pre-paid Android phone, expect full OS updates to be a very rare event indeed.

Because there are so many hands involved in getting an update to a device, it'll likely continue to only be flagship and upper-mid-range devices that see full OS updates. Or in other words, the chances of your device receiving a full OS update go up the more you spent on it.

TIME FOR A CHANGE?

But this is the problem – the current Android OS update ecosystem is a mess. Take a look at Google Dashboards and

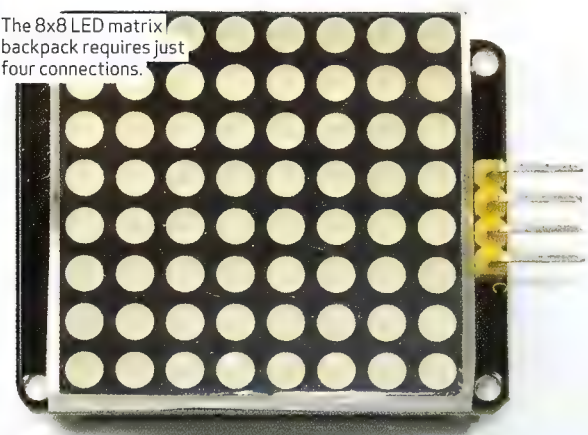
see the fragmented trail of past OS numbers (tinyurl.com/m7zm5cu). The most notable thing is that more than a quarter of all currently-used Android devices (29.2%) are still on three-year-old Android 4.4/KitKat and as of the 1st of August, after nine months on the market, Marshmallow/6.0 is still running on less than one in six phones (15.2%). By comparison, 88% of all possible Apple devices run iOS 9 after just one year on the shelf (as of the 29th of August).

However, in fairness, from personal experience, running even iOS 8 on an iPad 3 hasn't been frustration-free and the iPad 3 won't make it to iOS 10. Older devices with insufficient CPU power to handle everything a new OS has to offer can often lead to as much gnashing of teeth as not getting the update in the first place. But Apple gets props for at least offering that option (although I'd give them more if you could revert back to your old OS).

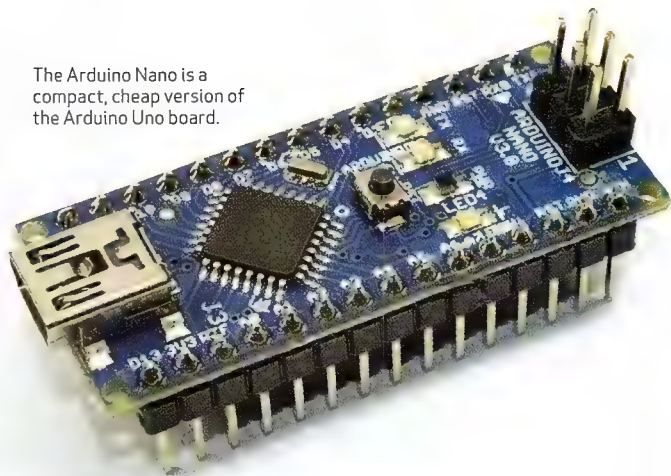
And did someone say 'security updates'? The US Federal Trade Commission (FTC) and the US Federal Communications Commission (FCC) certainly did – earlier this year, they began lining up mobile OS makers, phone builders and telcos for a 'please explain' on the whole security updates process (tinyurl.com/zjdfyfz).

Rumours are Google has a list of which vendors drag the OS updates chain the most and may make it public (tinyurl.com/hpurnbu). It probably wouldn't be a bad thing, either. The thing we all want from mobile devices is better battery life. However, the thing we all need is simple and timely updates. ■

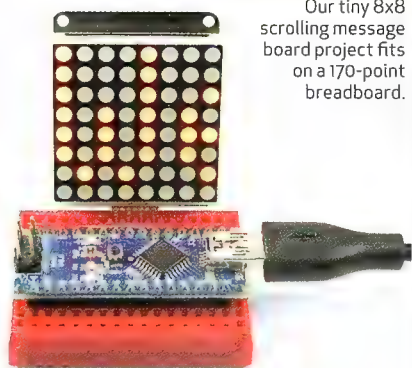
The 8x8 LED matrix backpack requires just four connections.



The Arduino Nano is a compact, cheap version of the Arduino Uno board.



Our tiny 8x8 scrolling message board project fits on a 170-point breadboard.



SETTING BRIGHTNESS

You can adjust the brightness by using a `matrix.setBrightness(level)` – where ‘level’ is an integer between 0 (dim) and 15 (bright). That said, we found ‘0’ more than bright enough for indoors.

SETTING ROTATION

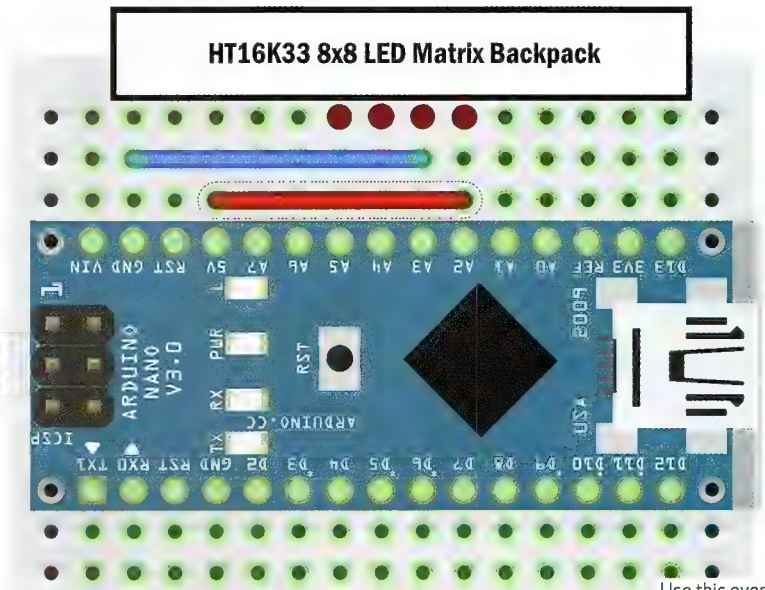
The Adafruit library can also rotate the display orientation. Because we’re plugging the matrix straight into a breadboard, we need to rotate the text to appear the right way around. Do this with `matrix.setRotation(int)` – where ‘int’ is an integer value between 0 and 3. Setting this to ‘1’ gives us the correct orientation for our application.

PLUGGING INTO THE NANO

The Arduino Nano supports I2C on its A4 (SDA) and A5 (SCL) pins. Thankfully, the pin arrangement on the 8x8 matrix allows us to plug it straight into position aligned with Nano pins A5 to A2. Pin A3 aligns with the HT16K33 module’s GND (0V) pin and pin A2 with the module’s Vcc (5V) pin. The nano has 5V and GND pins on this side of the board, so we just use wire links to connect these up – 5V to A2 and GND to A3. How do we do this without blowing up the A2 and A3 pins? Remember that, with Arduino boards, all analog and digital input/output (I/O) pins are initialised as ‘inputs’ unless specifically coded otherwise. Inputs have a high

Arduino Nano V3.0

APC 8x8 Message Board Overlay Diagram



Use this overlay diagram to wire up the project.

170-tiepoint breadboard

impedance and as we’re only connecting up standard nano-level voltages in 5V and 0V, those inputs are fine. The whole thing can be powered by any USB port or even a USB battery pack.

FLASHING THE CODE

Once you’ve downloaded the source code zip file, unzip it and copy the contents of the ‘libraries’ subfolder into the same in your Arduino integrated development environment or ‘IDE’ (download this for free from arduino.cc/download, we’re using version 1.6.9). Plug the Arduino Nano into your PC and from the IDE menu, select ‘Tools’, set the ‘Board’ to ‘Arduino Nano’, the ‘processor’ to ‘ATMEGA328’ and the ‘Port’ to the COM port for your Nano board. The COM port you need to select will be the one that is not ‘COM1’ – COM1 is your mouse, so if you only have two COM ports listed, choose the other one. Load the ‘messageboard.ino’ source code and from the IDE menu again, choose

‘Sketch’ and ‘Upload’. This will compile the source code into machine code for the Arduino Nano chip and upload it to the board. Provided you’ve followed the overlay wiring diagram and built your message board, within seconds, you should be seeing the ‘welcome’ message scrolling across the display.

Once you’ve programmed the nano board with your message, you no longer need the computer – just plug the Nano’s USB port into a USB battery pack or USB phone charger and the message will scroll indefinitely.

HAVE A PLAY

These 8x8 LED backpacks are incredibly useful and there’s a stack of different things you can do with them. Off the top of my head, I’ve got a couple of games, a clock and an audio spectrum analyser. Arduino really is a great way to learn how coding and electronics can come together to build almost whatever you want. ■

Learn to code Python — Part 3: Going loopy

Without loops, writing almost any app today would take forever. Darren Yates continues his Python masterclass with an introduction to self-repeating code.

Ever get into trouble at school where the teacher made you write out lines as punishment? If I could've beamed knowledge back to my 10-year-old self, I'd have written a couple of lines of Python code and had the whole thing done in a minute.

Getting a computer to do anything more than once requires you either write out code for each time you want that task completed, or you use a clever little function called a 'loop'. This month, we're diving into loops and looking at how they can simplify repetitive tasks.

LOOP TYPES

Python has two main code-looping structures – the ‘while’ loop and the ‘for’ loop. A while-loop will repeat a set of code statements as long as a control condition is true, whereas a for-loop will repeat a code-block for a pre-determined count. Or to put it another way, you use a ‘while’ loop when you don’t know how many times you want the code to loop, and a for-loop when you do.

THE WHILE LOOP

Imagine you're writing a simple guessing game, where the code picks a random number between 1 and 100, for example, and the user has to guess it.

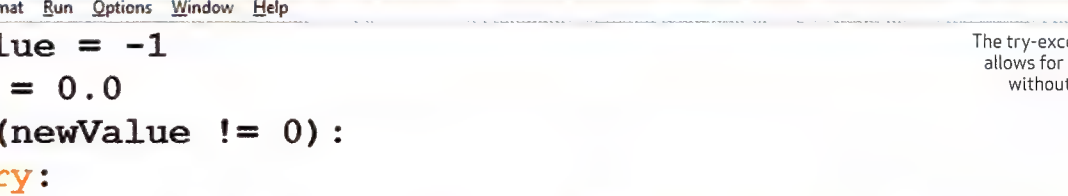
```
import random
newNumber = random.randint(1,100)
print("The badly-coded 'Guess a number between 1 and 100' game!!!")
guess = int(input("Guess what number I'm thinking of:"))
if (guess != newNumber):
    guess = int(input("Guess what number I'm thinking of:"))
    if (guess != newNumber):
        guess = int(input("Guess what number I'm thinking of:"))
        if (guess != newNumber):
            guess = int(input("Guess what number I'm thinking of:"))
            if (guess != newNumber):
                guess = int(input("Guess what number I'm thinking of:"))
                if (guess != newNumber):
                    guess = int(input("Guess what number I'm thinking of:"))
                    if (guess != newNumber):
                        guess = int(input("Guess what number I'm thinking of:"))
                        if (guess != newNumber):
                            guess = int(input("Guess what number I'm thinking of:"))
                            if (guess != newNumber):
                                guess = int(input("Guess what number I'm thinking of:"))
                                if (guess != newNumber):
                                    guess = int(input("Guess what number I'm thinking of:"))
                                    if (guess != newNumber):
                                        guess = int(input("Guess what number I'm thinking of:"))
```

The question you can't answer is how many guesses the user will need to guess the correct number.

Without a loop, you'd just have to load up as many 'input' and 'if' statements into your code as you'd think it would take to guess the number. Yuck! I've even written the 'Badly-Coded Number-Guessing Game' (**badguess.py**) to show you just how awful it looks — and it only allows 15 guesses before it gives up! But this is exactly where a while-loop is perfect — when you don't know how many times you need the code to run. The structure of a while-loop in Python is pretty straightforward:

```
while (condition-statement):
    code-statement(s)
```

The 'while' keyword starts us off and then there's a 'condition-statement' inside the brackets. Remember from last time, a condition-statement is one that can evaluate to true or false. The while-loop first tests the condition-statement and while ever that statement holds true, it runs the loop code. Let's say we have two variables, each holding a number – variable 'guess' holds the number the user guessed and variable 'correct' holds the correct number. A condition-statement can be



The screenshot shows a Python IDE window titled 'cashreg.py - C:\Users\Darren\Python Code\Python_EP_3\cashreg.py (3.5.1)'. The menu bar includes File, Edit, Format, Run, Options, Window, and Help. The code in the editor is as follows:

```
newValue = -1
total = 0.0
while(newValue != 0):
    try:
        newValue = float(input("New Price (0 = quit): "))
        total += newValue
        print('Total: ', "%.2f" % total)
    except ValueError:
        print("*** ERROR: Numbers only.")
```

A tooltip on the right side of the code editor states: "The try-except clause allows for user error without crashing." The status bar at the bottom right indicates "Ln: 5 Col: 47".


```

Python 3.5.1 Shell
File Edit Shell Debug Options Window Help
Python 3.5.1 (v3.5.1:37a07cee5969, Dec 6 2015, 01:54:25)
[MSC v.1900 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more infor
mation.
>>>
===== RESTART: C:\Users\Darren\Python Code\Python_EP_3
\cashreg.py =====
New Price (0 = quit): 34.95
Total: 34.95
New Price (0 = quit): 11.99
Total: 46.94
New Price (0 = quit): 4.95
Total: 51.89
New Price (0 = quit): 5f99
*** ERROR: Numbers only.
New Price (0 = quit): 5.99
Total: 57.88
New Price (0 = quit): 10
Total: 67.88
New Price (0 = quit): 12
Total: 79.88
New Price (0 = quit): 8
Total: 87.88
New Price (0 = quit): 0
Total: 87.88
>>>

```

Even with user error,
the cashreg.py code
correctly adds up prices.

```

Python 3.5.1 Shell
File Edit Shell Debug Options Window Help
Guess the number:11
Nope, wrong - guess again.
Guess the number:12
Nope, wrong - guess again.
Guess the number:13
Nope, wrong - guess again.
Guess the number:14
Nope, wrong - guess again.
Guess the number:15
Nope, wrong - guess again.
Guess the number:16
Nope, wrong - guess again.
Guess the number:17
Nope, wrong - guess again.
Guess the number:18
Nope, wrong - guess again.
Guess the number:19
Nope, wrong - guess again.
Guess the number:20
Nope, wrong - guess again.
Guess the number:21
Nope, wrong - guess again.
Guess the number:22
Nope, wrong - guess again.
Guess the number:23
Nope, wrong - guess again.
Guess the number:24
Nope, wrong - guess again.
Guess the number:25
You guess it!!!
>>>

```

While-loops can
handle loop
indefinitely...

the two variables are not equal, which
could look like this:

```
while (guess != correct):
    code-statement(s)
```

Now the code-statements inside the
while-loop (remember, they must be
tab-indented) will continue to loop,
executing in top-down order until the
while statement finds the value in
'guess' stops not-equaling the value
in 'correct'.

We can now write the whole code as:

```
import random
correct = random.
randint(1,100)
guess = 0
```

Get it

Here's what you'll need for this
month's masterclass:

Source code — apcmag.com/magstuff

Python 3 — www.python.org/downloads.

```
print("The better-coded
'Guess a 1-100 number'
game!!!")
while (guess != correct):
    guess = int(input("Guess
the number:"))
    if (guess != correct):
```

```
print("Nope, wrong
- guess again.")
print("You guess it!!!")
```

The 'import' statement imports the
'random' code library and the second
line uses the random library's 'randint'
(random integer) function to generate a
random number between 1 and 100,
storing it in the variable 'correct'. Next,
we initialise the 'guess' variable by
loading it with zero, print a welcome
message and then we hit our while-loop.
While the value of the 'guess' variable is
not equal to the value of the 'correct'
variable, we run the loop code. We start
by asking the user to guess the number.
The if-statement checks to see if the
user has entered the correct value.

```

goodguess.py - C:\Users\Darren\Python Code\Python_EP_3\goodguess.py (3.5.1)
File Edit Format Run Options Window Help
import random
correct = random.randint(1,100)
guess = 0
print("The better-coded 'Guess a 1-100 number' game!!!")
while(guess != correct):
    guess = int(input("Guess the number:"))
    if (guess != correct):
        print("Nope, wrong - guess again.")
print("You guess it!!!")

```

Using a while-loop is
a better way to code
a guessing game.

Ln: 10 Col: 0

how » coding masterclass

If the value of 'guess' is not equal to the value of 'correct', we print the 'guess again' output.

Since this is the end of both the if-statement and the while-loop code-block, it then goes back to the start of the while-loop to check the condition statement again and if the two variables are still not equal (meaning the latest guess is wrong), runs through the loop again. Hopefully, you can see this loop continues until the user either gets the right answer or puts a chair through the computer, whichever comes first.

FOR-LOOP

The while-loop is ideal for when you don't know how many loops you'll need, but when you do know, the for-loop is perfect. For-loops work differently, because you no longer have a condition-statement; instead, you have a variable that steps through a list of integers or strings, or, more practically, a range of integers using the 'range' function:

```
for variable in range(start,
stop, step):
    code-statement(s)
```

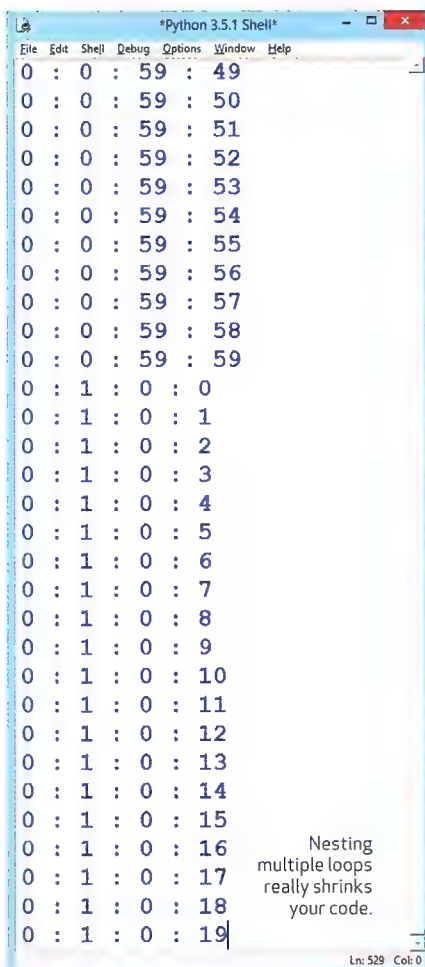
where 'start' is the initial integer start point, 'stop' is one past the last integer you want to count and 'step' is the gap between each integer. For example, to create a range of odd numbers between 1 and 10, you'd code:

```
range(1, 11, 2)
```

Let's say we wanted to add up the integers to 1,000 and print the result. We can do that easily using the following code:

```
total = 0
for nextInt in range(1,1001):
    total += nextInt
print("Sum: ",total)
```

We set the for-loop to run 1,000 times using the range function. The code within the loop is a short-hand for 'total = total + nextInt', or add the current value of variable 'nextInt' to the value of variable 'total' and store the result in variable 'total'. When the loop completes, it then prints the value of



```
*Python 3.5.1 Shell*
File Edit Shell Debug Options Window Help
0 : 0 : 59 : 49
0 : 0 : 59 : 50
0 : 0 : 59 : 51
0 : 0 : 59 : 52
0 : 0 : 59 : 53
0 : 0 : 59 : 54
0 : 0 : 59 : 55
0 : 0 : 59 : 56
0 : 0 : 59 : 57
0 : 0 : 59 : 58
0 : 0 : 59 : 59
0 : 1 : 0 : 0
0 : 1 : 0 : 1
0 : 1 : 0 : 2
0 : 1 : 0 : 3
0 : 1 : 0 : 4
0 : 1 : 0 : 5
0 : 1 : 0 : 6
0 : 1 : 0 : 7
0 : 1 : 0 : 8
0 : 1 : 0 : 9
0 : 1 : 0 : 10
0 : 1 : 0 : 11
0 : 1 : 0 : 12
0 : 1 : 0 : 13
0 : 1 : 0 : 14
0 : 1 : 0 : 15
0 : 1 : 0 : 16
0 : 1 : 0 : 17
0 : 1 : 0 : 18
0 : 1 : 0 : 19
Nesting
multiple loops
really shrinks
your code.
Ln: 529 Col: 0
```

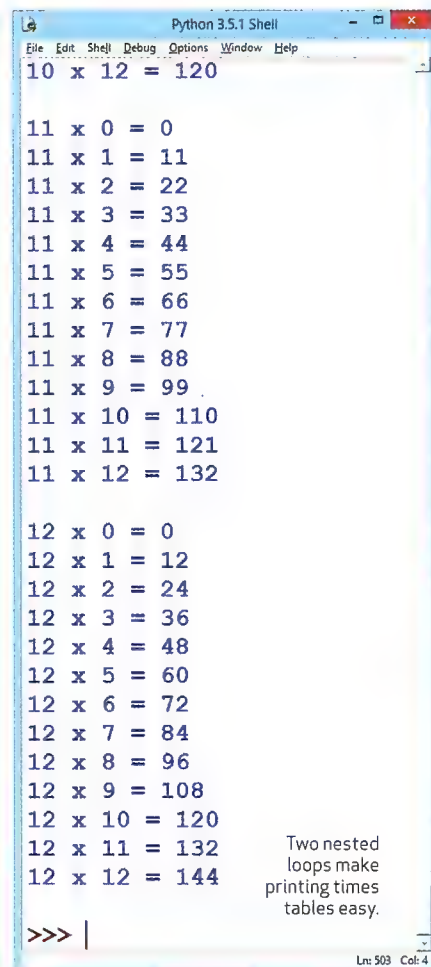
the 'total' variable to the screen. Now if I was ten years old again and asked to write out 'I will not leave my desk like a rubbish tip' 100 times, I'd write the following and go out to lunch:

```
for nextLine in range(0,
100):
    print("I will not leave my
desk like a rubbish tip.")
```

NESTED LOOPS

What's cool about loops is that you can also run loops inside loops. They're called 'nested loops' and they can save you even more lines of code.

Let's say we wanted to print out multiplication tables from one to 12. Without loops, we need 156 print statements to go from 1x0 to 12x12! With a single for-loop, we cut that down



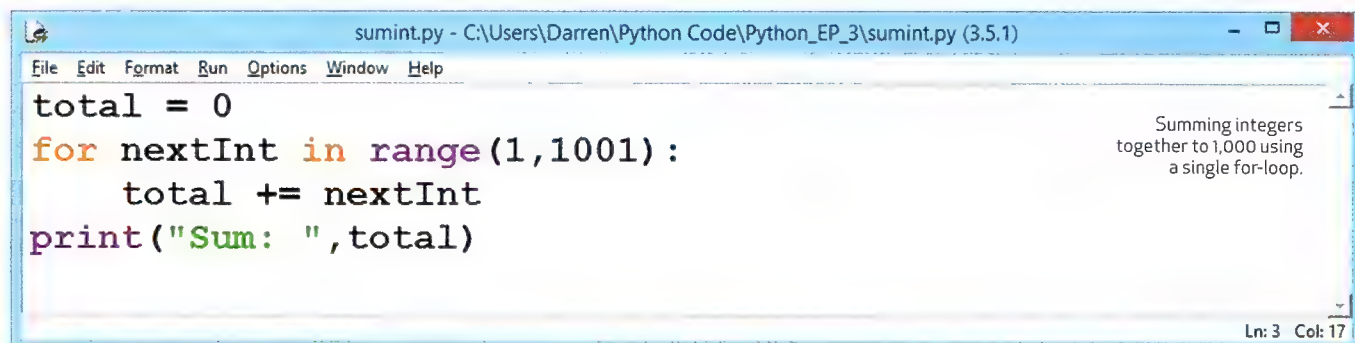
```
Python 3.5.1 Shell
File Edit Shell Debug Options Window Help
10 x 12 = 120
11 x 0 = 0
11 x 1 = 11
11 x 2 = 22
11 x 3 = 33
11 x 4 = 44
11 x 5 = 55
11 x 6 = 66
11 x 7 = 77
11 x 8 = 88
11 x 9 = 99
11 x 10 = 110
11 x 11 = 121
11 x 12 = 132
12 x 0 = 0
12 x 1 = 12
12 x 2 = 24
12 x 3 = 36
12 x 4 = 48
12 x 5 = 60
12 x 6 = 72
12 x 7 = 84
12 x 8 = 96
12 x 9 = 108
12 x 10 = 120
12 x 11 = 132
12 x 12 = 144
Two nested
loops make
printing times
tables easy.
>>> |
Ln: 503 Col: 4
```

to 15. But with nested loops, we drop that to just four:

```
for num1 in range(1,13):
    for num2 in range(0,13):
        print(num1,'x',num2,'=
',num1*num2)
    print()
```

But how do nested loops work? Let's call the 'num1' loop the 'outer' loop and the 'num2' loop the 'inner' loop. Here's what happens – the outer loop starts at the beginning of its range, which is '1' and starts to run its loop code. The first line of that loop code is the inner for-loop – it starts at the beginning of its range, which is '0'.

The inner loop then begins its loop code, which is the print statement. Num1 as '1' and num2 as '0' gives the



```
sumint.py - C:\Users\Darren\Python Code\Python_EP_3\sumint.py (3.5.1)
File Edit Format Run Options Window Help
total = 0
for nextInt in range(1,1001):
    total += nextInt
print("Sum: ",total)
Summing integers
together to 1,000 using
a single for-loop.
Ln: 3 Col: 17
```



```

from time import sleep
for days in range(0, 7):
    for hrs in range(0,24):
        for mins in range(0,60):
            for secs in range(0,60):
                print(days, ':', hrs, ':', mins, ':', secs)
                sleep(1)

```

print-statement result '1 x 0 = 0'. That's the end of the inner loop code, so we go back to the inner loop's for-loop code line, which increments num2 to '1'. We run the inner loop code again and the result is '1 x 1 = 1'. This inner loop continues until we get to '12' and the print result '1 x 12 = 12'.

At this point, the inner loop has now completed, we jump back out to the outer loop, which finishes by printing a blank line for clarity. That's the end of the outer-loop code, so we go back to the outer for-loop code line at the top, which increments variable 'num1' to 2.

We now run the outer-loop code again and the first line is the start of the inner loop. This begins at the start of its range, being '0' and then runs the inner-loop code, which is the print statement, this time giving '2 x 0 = 0'. The loop code completes and goes back to the inner loop for-loop code, incrementing num2 to '1'. We run the inner loop code and print '2 x 1 = 2'.

Cutting a long story short, the inner loop must fully complete its run each time before incrementing the outer loop, but as you can see from the output, the result is a complete 12-times table from 1 to 12 in just four lines of code.

KEEPING TIME

In theory, there's no limit to the number of loops you can have nested, but in practice, you want to keep a lid on it, otherwise things can go pear-shaped. A simple example of four nested loops is building a timer with seconds, minutes, hours and days. Obviously every 60 seconds is a minute, every 60 minutes an hour, every 24 hours a day and every seven days a week – sounds ripe for nested loops. Here's how it looks:

```

from time import sleep
for days in range(0, 7):
    for hrs in range(0,24):
        for mins in
range(0,60):
            for secs in
range(0,60):
                print(days,':',
hrs,':',mins,':',secs)

```

```

for num1 in range(1,13):
    for num2 in range(0,13):
        print(num1, 'x', num2, '=', num1*num2)
    print()

```

sleep(1)

The code here is similar to the times tables, except that we now have four loops running. The easiest way to think of it is the inner loop always spins the fastest and the outer loop, the slowest.

The two lines of code you won't have seen before are the 'import sleep' and the 'sleep(1)' statements. The first imports the 'sleep' function from the Python's time library and the second forces the code to sleep – 'do nothing' in other words – for one second. Now in practice, this is a horrible way to code a timer because that one-second sleep delay won't be exactly one second. There are much better ways to do this, but we're not quite there yet, so we have to crawl before we can walk. That said, the looping works perfectly and if you watch the output, you'll see that each time unit meets its specified range. To speed things up when running the code, just delete the last line. Close the Python Shell to get it to stop.

GET IT RIGHT

Finally, we'll combine a while-loop with a new feature to perform some on-the-fly user input validation. Suppose we're writing a cash-register program to add up a series of prices – what do we do if the user accidentally enters in non-numeric characters? This is why user input validation is so important – you want to be able to cope with user error without the code crashing.

Open the 'cashreg.py' source code and take a look. You'll see it has a single while-loop, but inside the loop is a new function, the 'try-except' clause. You can think of this as a bit like an if-else statement for error-checking. In the

'try' clause, you load up the statements you want to try to run – in this case, asking the user for a new price, adding it to the total and printing the total nicely to the screen. In that first line, we're trying to turn the input into a floating (decimal) number, but if the input contains alpha-characters, it'll create an error. Normally, the code would then crash, but here's where the 'except' clause comes in – the error generated is a 'ValueError' error, which the 'except' clause now catches, runs its print code line and warns the user. Since this is also the end of the while-loop code, we go back to the while-loop condition-statement, which is still true (the user hasn't entered zero), so the while-loop runs again, hits the try clause and asks the user for a new price. If the user gets it right, it adds the new value to the 'total' variable, prints the total, skips the except clause and goes back to the while-loop condition-statement again.

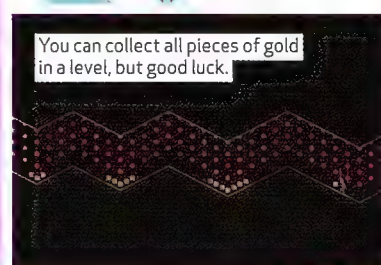
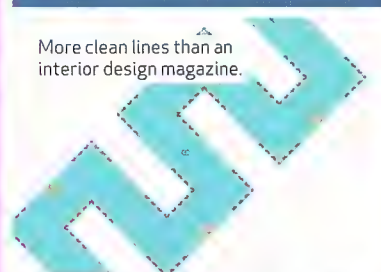
If the user enters '0', meaning they've had enough, the try clause continues, adds zero to the total, prints it, skips the except clause, goes back to the while-loop conditional-statement, which, this time, is no longer true, quits the loop and we can all go home.

GET INTO IT!

Being able to code will be one of the key skills to have in the next ten years and Python is an ideal way to get the basics under your belt. We're moving along at a decent clip, so if you're struggling a bit, the best thing is to sit down and play with the code. You can't learn to drive a car from just reading the manual and the same goes for coding, so get into it! ■

downtime

» GAMES: EDITED BY TROY COLEMAN



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apc
HOT PRODUCT

N++

The perfect version of the floaty ninja platformer.

There isn't much of a narrative in *N++*, but the one that does exist is as threadbare as they come. You're a ninja, thus you're able to run and jump very well. You enjoy gold, so you collect it but, more importantly, you like to live – even though your life expectancy is "1.5 minutes" according to developer Metanet. That's a charitable estimate.

Even that deliberately banal premise risks complexity: the bottom line is, like the original flash game *N*, and then the Xbox exclusive *N+* after it, there's nothing to do in *N++* except jump and evade obstacles on your way to the end of each level. There are no puzzles, no plot twists and no fancy new skyboxes or environments. And forget about the ninja stuff – it doesn't matter. There are

more than 1,000 levels of dangerous platforming, and that's all it needs.

The spartan premise is matched by its art style of severe lines and high-contrast colour schemes. And yet it's beautiful, in the way grace and fluidity is prized to an almost fetishistic degree: seeing this game played well is like a modernist drawing come to life, and the game's slowly ramping difficulty ensures that you're always on your way to mastering the nominal ninja's rather unorthodox movement.

Regarding that movement: jeez, is it floaty. *N++* is all about momentum, with the height of each leap dependent on the speed and angle at which you approach it. When you've learned to chain together light wall jumps, bunny hop between platforms and glide serenely between laser beams and floating sentries, you're going to

feel like a ninja with an interpretative dance degree. *N++* requires hair's breadth precision at times, but even when it's insurmountably tough, it just feels brilliant. It can be played with no concern for winning, because handling the ninja is its own reward.

Not that there's any risk of ever completing the game. There are 1,125 levels across 225 episodes. And if you have the stamina and skill to finish them all, there's a level editor with all the tools needed to rival the vanilla creations. Levels can be uploaded and played across both PC and PS4 versions, but while there's a 'featured' tab, which appears to be curated, many of the user levels are poor.

If there's another problem I have with *N++*, it's one inherited from its predecessor: the requirement to play

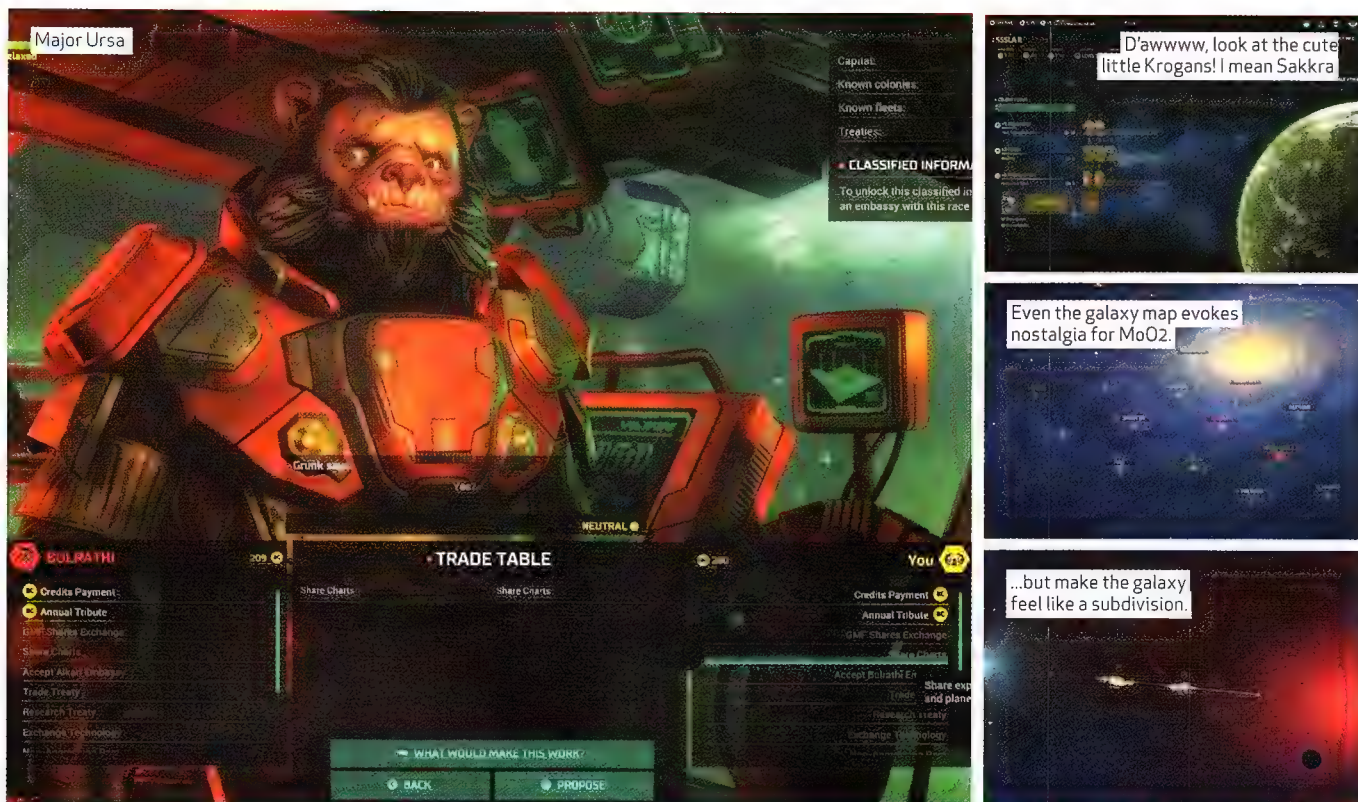
through levels in episodes. Each episode is a sequence of five levels, and all five must be finished to secure completion. Later on, when certain individual levels can take hours (sometimes days) to master, this requirement can be overwhelming.

When I first played *N++* on PS4 last year, I thought it would be the last action platformer I'd ever need. That sentiment still stands: there are few platformers, classic or modern, that can rival *N++* in terms of physics, fluidity, level design and sheer size. For anyone with even a vague affection for platforming, it's a game to play for years to come. ■ Shaun Prescott

Verdict

A masterful distillation of classic action-platforming, doling out tension and elation in equal measure.





US\$29 | PC | WWW.MASTEROFORION.COM

Master of Orion

Shines bright, but doesn't show us much we haven't seen before.

It's an impressive reboot, but this is a release that's stubbornly dedicated to recreating first-generation ideas and the 4X experiences of yesteryear.

In single- and multiplayer, these experiences usually involve founding and managing colonies, while sending scout ships out to nearby stars to find what may be hiding there. Sometimes, you'll find untouched planets to colonise, on other occasions you'll find aliens to befriend or crush.

There's a lot of extra stuff sandwiched in menus between all that: raising taxes, following a lengthy tech tree, designing custom ships, or figuring out how to juggle a planet's population for maximum production. But one good thing about the new *Master of Orion* is that it never gets out of hand. If anything, it's far more accessible and streamlined

than the earlier games it's based on.

Part of Wargaming's reason for reviving *Orion* was to introduce a new generation to 4X gaming, and there it succeeds admirably through the help of an optional adviser and a UI that conveniently draws attention to different elements as the turns pass.

Ironically, most annoyances spring from the few additions to the template, such as the tendency for planets to need cleaning after getting too polluted, which gets tiresome with multiple worlds. Also, 'star lanes' keep ships on straight paths between star systems, sometimes shattering the illusion of an open galaxy with traffic jams.

The additions aren't always bad. I'm particularly fond of the shift from turn-based to real-time combat in the battles that pop up when you fight alien civilisations or pirates. It's a

point of contention for the fans, but I've learned to admire the comparative speed of the approach and the way the right combination of timing and skill can let me use my smaller ships to outmanoeuvre the enemy's larger ones.

Master of Orion's greatest triumphs are those of personality. All those bucks spent hiring Hamill and friends went to good use, as it's always fun to watch the animated leaders bicker and cheer in the diplomacy screen and the minions of your chosen race give you advice in the research screens. There's even a little news show that sometimes pops up with two robotic newscasters recounting the big events happening between turns, which serves as a form of comic relief.

It's a shame, then, that the civilisations' differences usually stop at imagery and voicework. This may be a galaxy of 11 advanced races including warrior lizards,

sexy cats and cruel robots, but venture deep down their technology trees and you'll find they all amount to the same thing in practice. And while I wouldn't call the AI a failure, it's prone to puzzling actions such as twiddling its thumbs after diplomacy negotiations lead allies to declare war on your enemies.

A master of the 4X universe this is not, but neither is this unenjoyable, as its lively presentation, personality and occasional humour do much to shore up its weak points, and its comparative accessibility make it a decent option for anyone wading into the genre for the first time. But for depth? There are many worlds other than these.

■ Leif Johnson

Verdict

A fun, serviceable update to the 4X legend that brings little memorable to the genre aside from its personality.





It's a peaceful, easy-going game for the most part.



You go so high you can see the curve of the planet.



This is BUD's new glider.



The desert biome is full of these weird cacti.

FROM US\$11.95 | PC, PS4, X1 | WWW.GROWUPGAME.COM

Grow Up

Takes procedurally-animated robot BUD to new heights.

Last year, Reflections released *Grow Home*, a charming physics-driven platformer starring a robot called BUD. It was a rare example of a major studio, in this case Ubisoft, backing something a bit more unusual and experimental than their usual fare. And it was brilliant, with joyous procedural character movement, a stylish polygonal art style, and a unique central conceit – growing an enormous star-plant to reach the top of the map.

Grow Up is more of the same, but in the best possible way. They really didn't need to tinker with BUD's movement much. His lurching, drunken momentum feels unusual at first, but wrestling against the physics is part of what makes the platforming so enjoyable. Getting him to the top of something without falling off is hilariously precarious, but make it and

it's hugely satisfying. *Grow Home* was largely a game about careful, patient climbing. The higher you got, the more tense it was, especially with BUD lolling and staggering like a drunken teenager. It wasn't until you got the jetpack, and upgraded it, that you could start taking risks, making death-defying leaps between platforms.

In *Grow Up*, this bravery comes much earlier. In the first hour or so, you'll have the jetpack, an air brake to stop you smashing into the ground after a fall, and a glider that lets you fly for a fairly long time. And this is by design, because the world is much bigger. *Grow Home* was set on an island surrounded by water, while *Grow Up* takes place across an entire planet, with three different biomes to explore.

While I do miss those moments of terror when you were clinging to the star-plant with the ground miles below you, the comparative

freedom is liberating. You can fling BUD around with abandon, and although you still have to battle physics to keep control of him, you don't have to worry about falling or losing progress.

And then there are the floraforms. Everywhere you look are strange, alien-looking plants that can be taken advantage of in some way including mushrooms you can bounce on and flowers you can grab hold of that shoot high into the air. All of these can be scanned and added to your floradex, which lets you toss a seed and grow one wherever, and whenever, you like.

This does diminish some of the challenge of reaching the world's highest points, but I don't mind because they're so much fun to experiment with. *Grow Up* is primarily a platformer, but the floraforms also make it a brilliantly silly, entertaining physics sandbox.

Your ultimate goal is essentially the same. In *Grow*

Home you were trying to reach a floating ship, here you're trying to reach the moon. And to do so, you need to make use of star-plants. Grab the tendrils that sprout from their stems and they'll begin to grow, and guiding them towards a floating 'energy rocks' will make the plants increase in size.

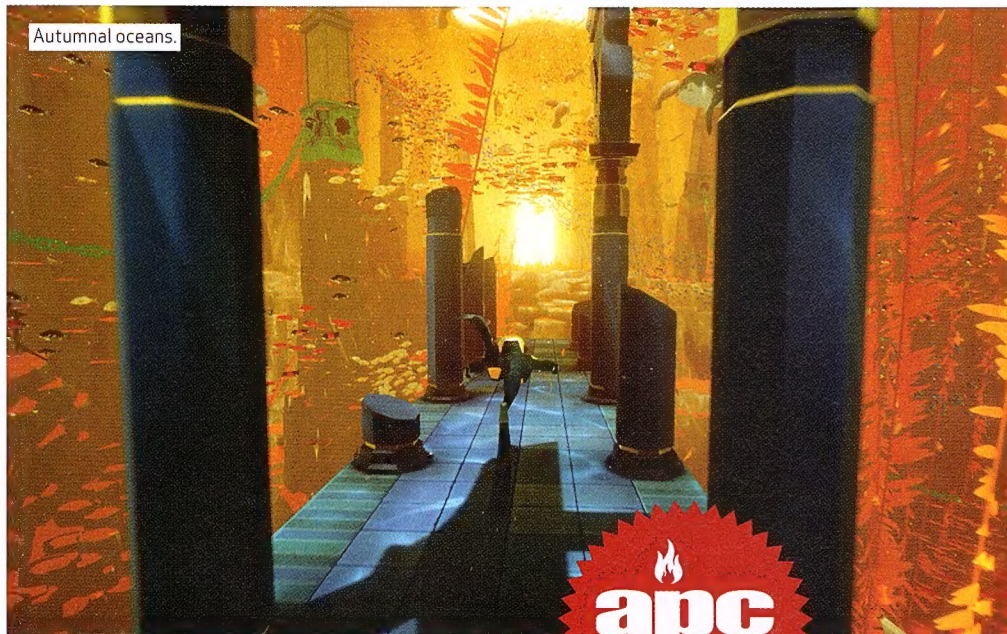
Even though the setting is larger, and there's more to do, *Grow Up* is still a very lean, minimalist game. It's ultimately an experimental platformer, developed by a tiny team, and it feels like it. But it's also a joyful, light-hearted slice of daft physics fun, set in a gorgeous, colourful world. And sometimes that's enough.

■ Andy Kelly

Verdict

A superb remix of *Grow Home* that gives BUD a bigger, prettier sandbox, at the expense of some challenge.





Autumnal oceans.

US\$19.99 | PC, PS4 | WWW.ABZUGAME.COM

apc
HOT PRODUCT

Abzû

A gorgeous adventure from a few of the minds behind *Journey* and *Flower*.

This giant squid isn't the kind who'd take down a ship or duke it out with Moby Dick. Still, it's huge, roughly three times my length from tip to tentacle. Its pancake eyes look me up and down. I'm getting sized up by an intelligent, curious creature. We swim together, then I do a somersault to signal I'm off. The squid doesn't care, which is fine. But for a moment, I was with an impressive, abstract being, thinking about what it might be thinking about.

I wasn't concerned about solving puzzles or a health bar or where to go next — only with swimming and seeing and understanding.

Abzû is an expertly directed psychedelic marine tour without a single UI or text prompt telling you where to go or what to do, purely driven by curiosity. You play a nameless diver with an infinite lung capacity, leisurely moving on a linear path from one big underwater environment to the next. You might have to pull a lever and you're encouraged to steer clear of certain objects later on, but

your progress is never gated by puzzles or actual danger.

Swimming feels great. The diver cuts through the water, frictionless and easy to manoeuvre. One button does a powerful dolphin kick and another performs a somersault in whatever direction you're pressing. It's unnecessary, but it's a flourish that encourages movement for the sake of it.

I lingered for a long time, following schools of fish to get a better look, piggybacking a hungry grouper, or trying to keep pace with a manta ray fleet. I reenacted the iconic scene from *Free Willy*, tried to hug a giant squid, and did a barrel roll on a humpback whale through a torrential cyclone of silvery fish. They dynamically parted around us, spinning off in erratic patterns, and returned to their flashy tornado. It's one of the most beautiful, bizarre things I've done in a game, and it felt like my idea.

To really soak in this world, you can 'meditate' on statues in each environment, which let you leave the perspective of the diver and use the camera to select any

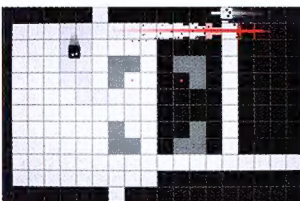
present organism to follow them around. It's like bouncing around in a psychedelic marine documentary. But in place of narration, the journey is elevated by an amazing score from Austin Wintory.

The story, though? It's simple: a ruined underwater civilisation that once lived in harmony with nature lost sight of that relationship and started exploiting the creatures it once worshipped. Technology rolls in, cast as an industrial menace, and does its destructive thing.

But when *Abzû* doesn't paint silly expositional hieroglyphs on the wall, when it presents me with beauty and behaviour and lets my mind go where it will — that's when I felt most affected. It's a short, dense journey filled with wonder, and every inch is worth seeing. ■ James Davenport

Verdict

Gorgeous, invigorating *Abzû* flounders a bit with a hamfisted story, but there's still nothing quite like it on the PC.

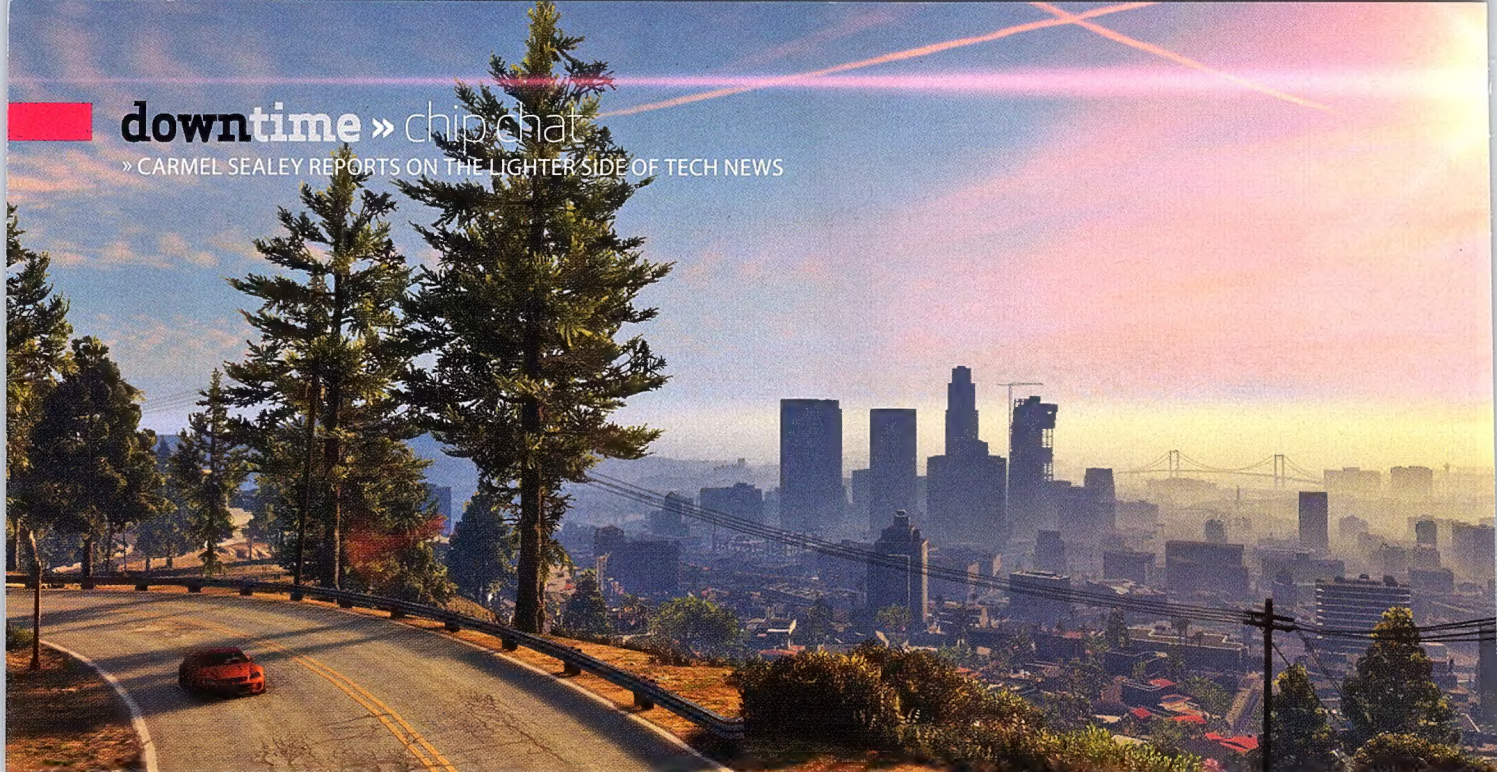


Inversus

All hail the new Bomberman

US\$14.99 | PC, PS4
WWW.INVERSUSGAME.COM

For a game that contains just three or four colours and a handful of geometric shapes, Hypersect's top-down shooter sure manages to generate a lot of gratifying audiovisual spectacle. Bullets fizz and crackle as they cross the screen, enemy ships explode with an indulgent crunch, and the arenas you play on are constantly transformed by your trigger-happy antics. That's because *Inversus* is built around a single, ingenious rule: you can only travel on tiles of the opposing colour. So playing as a nippy little black craft, you'll find yourself limited to zipping around on the stage's white tiles. Fire off a bullet, though, and it'll transform every tile it touches into a welcoming white — good news for you, but bad news for your ivory adversary, who can only travel on black tiles. All that may sound fussy and complicated on paper, but it proves effortlessly intuitive with a pad in the hand. Get a few pals together for a multiplayer dustup and *Inversus* plays out like a minimalist *Bomberman*. The option to take the fight online promises big fun, but its servers are disappointingly deserted, and opponents prove hard to come by. Fortunately, Arcade mode represents more than a throwaway addition, offering surprisingly intense score-attack survival. It may be built from pretty basic building blocks, but *Inversus* combines them into satisfying and strategic shapes. ■ James Nouch



Your Telsa's been playing *Grand Theft Auto...*

But don't panic — that's actually a good thing!

Playing thousands of hours of *GTA* could be beneficial to AI, due to the use of computer learning. While the games are notorious for carjacking, hit-and-runs and the criminal underworld, it's the photo-realism of the environments that are more interesting to researchers from Intel Labs and Darmstadt University in Germany. Collecting the huge amount of data required for machine learning is challenging and time-consuming, so in a game such as *GTA* (which aims to provide a life-like environment in which to play), the AI could collect data that is as reliable as anything collected while on an actual real-life street. Just... don't let them anywhere near Trevor, please.



Don't buy this USB stick

WELL, UNLESS YOU WANT TO BLOW YOUR STUFF UP.

This is not a design flaw — the USB Killer stick can destroy pretty much anything that's unlucky enough to be in its sights. Plug this unassuming device into your laptop, printer, TV or whatever tickles your fancy, and the stick will "test the surge protection" by rapidly charging its capacitors. Once charged, it quickly discharges its stored volts back into the device. This process is repeated several times per second. While it may sound like a tool on a criminal's belt, it's actually a device used to test hardware protection against electrical surges — natural or malicious. If the hardware fails, it's essentially melted on the inside. You'd hate to label your USB sticks incorrectly...!

Crowdfunded cat pics take over London Tube station

ALAS, NO SIGN OF SKIMBLESHANKS.

If you went to Clapham Common Tube Station in London during September, you would probably remember the dozens of ad boards that featured adorable pictures of cats. However, this was far from an act of kind-hearted and amusing vandalism — it actually came about thanks to a crowdfunding campaign from the Citizens Advertising Takeover Service (CATS), which involved 683 backers and £23,000. The campaign was to take over Clapham Common for two weeks for three main reasons — one, because "it would look amazing"; two, to not have to look at ads trying to sell you products you don't want; and three, to help find cats loving homes, because each cat poster featured stray kitties looking for a new forever friend. 'I can has Tube station?' You certainly can.

Foosball-playing robot is too good for humans

COME ON, REF! THAT WAS CLEARLY OFFSIDE! ARE YOU BLIND?

We already know that AI can drive cars better than we can and will soon rule the world, but we at least thought we had a few years up our sleeves before they could beat us at soccer. Ah, yes, well... do you want the bad news now? Students at Switzerland's École polytechnique fédérale de Lausanne (EPFL) Automatic Control Lab have constructed a robotic foosball table that uses a camera tracking system that takes 300 pics per second. This information is then processed and the arms move accordingly. While this foosball robot is more than capable of beating a human opponent, the creators aren't stopping anytime yet, with plans to further develop its prediction skills. ■

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